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WAR'S NEW WEAPONS

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A marine Zeppelin of the "Hansa" type resting on the water. In the corner, attached to a military aeroplane, is the Scott-Dewitz bomb-dropping apparatus.

WAR'S NEW WEAPONS

An Expert Analysis in Plain Language of the Weapons and Methods Used in the Present Great War

By

BARON HROLF VON DEWITZ

WITH INTRODUCTORY PREFACE BY

HUDSON MAXIM

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PREFACE

THERE are two national crimes of equal enormity—the one that of military aggression, and the other that of unpreparedness in respect of the necessary safeguards against aggression to protect the property and homes and families of those who depend on us and trust us to safeguard them.

One after another of the surrounding nations will likely be drawn into the war before it is over. After the present belligerents have settled their scores with the sword, there will be other scores to be settled between the victors and the neutral nations. Differences between the warring and the neutral powers—differences which, in time of peace, might produce very strained relations or precipitate war—may now be lightly passed over as mere discourtesies. But after the war, some of the acts of the neutrals that at present seem quite insignificant may be magnified to advantage as *casus belli*. It is my opinion that, whichever side wins, the United States will likely have to fight the winner within a short time after the war is over, for neither the Germans nor the Allies, in the heat of passion that now dominates them, will feel in a mood to forgive some of the things which we may feel compelled to do in the main-

tenance of our neutrality. In short, the things which we may be led to do to avoid being embroiled in the present war may serve to embroil us with the victors, unless the war should end in a draw.

It is now such an old, old, threadbare story, that it no longer needs repetition that our standing army is a mere corporal's guard; that our militia could stand before a trained army just about as long as a small boy could stand before a John L. Sullivan, while our navy is absolutely inadequate to defend our coast cities or to secure the country against invasion.

Our army and navy men, who have been educated in these things, and who ought to know, tell us that our position is pathetically defenceless. They tell us that, should our navy be destroyed or evaded, and an army of only a hundred thousand men, equipped with all of the arms and paraphernalia of modern warfare, be landed on our coast, that army could go anywhere it should see fit, live off the country, capture our big cities, and hold us up for ransom in spite of all that we could do.

These good authorities tell us that we have not men enough to man the few guns that we have; that we could not put more than thirty thousand trained men in the field within the first month; while, should the invading nation need more men, it would have some millions in its standing army from which to draw. Any of

the great powers could spare a few hundred thousand, or a million men, if need be, for the conquest of the United States.

Take a map of the United States and a pair of compasses and strike a circle, with a radius of a hundred and sixty miles around Peekskill, New York, as the centre, and in that circle will be found ninety per cent. of the arms and ammunition works, military stores, smokeless powder works, torpedo works, torpedo-boat works, arms and armament works, of the entire country, together with the principal coal fields of Pennsylvania. Within this circle will be included not only New York, but also the city of Boston on the East, and the city of Philadelphia on the West, and all cities between. What an enticement for invasion! What a prize for the invader!

The conquest of this area will not be a work of months, or of years, but only of a few days, and the thing will be done before we shall have time to mobilise the available fighting forces we have, much less to enlist and train and arm a citizen soldiery.

This vital area is the solar plexus of Uncle Sam, and an army of a hundred thousand trained men landed on our Atlantic seaboard will be able to capture this entire area and subdue the populace as easily as the police force of New York can subdue a rioting mob.

The enemy may annex the captured territory,

just as Belgium has been annexed by Germany, and then, not only will we all be taxed to support the war, but also we shall be conscripted to fight in the ranks of the enemy against our own people, and we shall all be put to work with an exceeding busy-ness operating our smokeless powder factories, our gun factories, our ammunition works, to turn out war materials for the enemy.

This is an age of mechanics, an age wherein man-made mechanism more and more replaces hand work. Everywhere in our industries of peace, we have seen labour-saving machinery replace the labour of human hands.

To-day, all the men in the world could not do by hand all of the world's ploughing and sowing and reaping and carrying of the world's food to market; and all the women in the world could not to-day do the world's sewing without the sewing-machine, and all the men in the world and all the women in the world combined could not to-day do a tenth of the world's writing without the typewriter and type-setting and printing machinery. One of the giant dredges that have been ladling out of the Panama Canal the vast landslides can do the pick and shovel and wheelbarrow work of a thousand men.

Everywhere, in everything we do, and in everything done for us, we find human hands now mainly engaged in guiding the work of labour-saving machinery.

The people of the United States of America have been able to develop their enormous resources and keep abreast of the world's industrial progress mainly by the invention of labour-saving machinery under the protection of our patent law.

In our competition with other nations for the markets of the world, no one thinks of referring to the prowess of our unskilled citizen soldiers of industry unsupported by machinery, but all reliance is placed upon our multiform labour-saving machinery, and our skilled labour behind that machinery.

With these pregnant facts before us, it is strange that it should not be very plain to every one that what is true of labour-saving machinery in peace is likewise true in war. It is very strange indeed that there should be intelligent men and women among us unable to see and to understand that labour-saving machinery and labour skilled in its use are as applicable and as indispensable to successful warfare as to peaceful industry. Furthermore, labour-saving machinery in war is life-saving machinery. The rapid-fire gun is the greatest life-saving instrument in the world.

These persons do not seem to appreciate that war is an industry. As a matter of stern fact, war is and has always been the biggest and the most vital industry of mankind, and in no other industry is labour-saving machinery so import-

nut and so vital, and in no other industry does so much depend upon the skill of the labour operating the machinery.

We are the slaves of belief, and we love our chains. Although our faith may be false, we hate the hand that tries to free us. The people of this country have a great false faith in the fighting qualities of their citizen soldiery, improvised in time of war. They point proudly to the War of the Revolution and the War of the Rebellion to prove how our volunteer soldiers can fight. They overlook the fact that fighting then was mostly done by hand; that now it is mostly done by machinery and that it is just as foolish and absurd to think of taking untrained men off the farm to operate the guns and machinery of war as it would be to try to operate the factories with them where the guns and machinery are made.

It takes as long to-day to convert a farmer into a skilled soldier as it does to convert him into a skilled mechanic.

A citizen soldiery without years of training in the discipline and weapons and mechanism of modern warfare is only a mob, as easily scattered by a few real soldiers as chaff by a whirlwind.

We, like a lamb rampant believing itself to be a lion, have been bestriding the world with big arrogance, and have flaunted our Monroe Doctrine before the eyes of all the nations, bliss-

fully unaware of the fact that we have comparatively no more fighting potentiality to protect our Monroe Doctrine, should there be a coalition of any two nations against us, than a pet pup would have to force obedience in a den of tigers.

Therefore, I gladly hail the present work of Baron von Dewitz as a book which deals ably with the ever transcending strategic uses of War's New Weapons.

There are no subjects at the present time more deserving serious attention and examination by all thinking persons than the subjects treated in this volume.

Baron von Dewitz, a subject of Denmark, very naturally views the present European conflict with the eyes of a neutral. He has endeavoured to present facts as he has found them, and without partiality, and his handling of the specialised branches of modern warfare and weapons is that of a military expert.

He is somewhat of a poet, however, and fills the mind with creepy imaginings about night-hawking air-craft. His considerable actual personal experience with air-craft enables him to speak with a very authoritative fancy, even when he is poetical.

Baron von Dewitz has a masterful knowledge of military tactics and the philosophy of warfare. His descriptions in interesting detail of the use of wireless telegraphy on the airship and

on the battlefield show an intimate knowledge of this most valuable arm of naval and military service. His talk on the submarine and its operation, and his enlightening descriptions of the other weapons of warfare, make one burn the after-midnight oil, finally to lay the book down with reluctance in the wee hours of the morning.

Baron von Dewitz is deserving of the deep gratitude of the American people, for by this book he makes a strong appeal to their needed realisation of the significance of modern war machinery, and the imperative necessity of drilling and educating a dependable army for its use, both to fore-fend ourselves against war, and, in the event of war, to save us from humiliation and defeat.

HUDSON MAXIM.

New York, March, 1915.

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WAR'S NEW WEAPONS

CHAPTER I

AIRCRAFT

An Aërial Night Attack

The good city has closed its solid, stony countenance in peaceful sleep. A round, chubby moon, riding behind curtains of cloud, peeks down with the mien of a patriarch upon the empty streets and large, open squares, where no one is afoot, and upon the broad river that flows unrippled and blinking through the city's many arched bridges.

Here and there a tall, menacing spire consecrates the crowding roofs with a finger of sombre shadow. Is it chance or heaven that joins two long shadow-fingers in a huge cross over the heart of the city! In the centre thrones a lordly pile gathering under its dome the prayers of holy men and prostrated multitudes.

There are no lights anywhere. There is no motion. The city lies lifeless with the aspect of having been deserted. From the woodlands on its borders comes sigh upon sigh as the rising breeze rustles through the leafage. The sound of it rises and dies away in scarcely audible

cadence like the breathing of some vast, multitudinous sleeper stirring uneasily in his dreams.

A flight of cranes and storks passes over the housetops dragging a weird, jagged shadow—birds of passage headed wrong and out of season. As they speed over the outer forts a pale shaft of light pierces the fluttering flock—the ever vigilant eye of a garrison ever apprehensive of the enemy.

The big clock under the cathedral dome tolls off the second hour past midnight. Stillness broods once more over the rapt city. But for the slow-breathing moorlands there is no sound.

A large cloud curtain obscures the moon. Out of its folds glides a long, ghostly object. At first it moves with the cloud, but presently it breaks away and ranges forward with uncanny speed. Issuing from the clouds it seems to be of the clouds, so gauzy and ethereal does it look. Nearer and nearer does it move, noiselessly increasing its speed in a huge, sweeping curve, its long, sleek sides and tapering points resembling the shape of a monstrous shark! Of a sudden it reels out a dark object trailing on a thread and sails across the city. Something drops hissing and screaming through space. A vicious knife-edge of smoke points downward. A lurid flash shoots upward. Then a thunderou roar as of an earthquake blasts the air and sena echoes tumbling in muffled rumblings. Agai

a hiss, a flash and a thunderclap, and again and again before the searchlights on the bastions can concentrate on that most dreaded enemy of modern warfare, the aërial dreadnaught.

In a twinkle the slumbering city is on its feet. The long pencils of its searching eyes flood the night in a brilliant glare. The rapid-fire artillery on the forts crashes away, streaking the night with screaming shells that explode with a wicked, lurid spurt of fire. From a thousand different posts, where sharpshooters have been stationed throughout the city, the rifles of infantry squads pop away like bundles of firecrackers, holing the air with swarms of humming bullets.

Windows are thrown open everywhere and as quickly slammed. Crowds of people surge out upon the streets, only to be driven back under roof by the infantry pickets. The searchlights do not seem to avail against the blue-goggled crew of the aërial monster that soars above gun-range planting heavy, explosive bombs at will of its daring commander. The shells of the rapid artillery rend the air in vain. The bullets of thirty thousand pickets, firing incessantly, are also spent in vain, never reaching the aërial cruiser that vanishes as quickly as it came.

And in a ghostly shower of lead and steel these missiles fall back upon the pickets, crash-

ing through glass and tile, plumping into the blinking river, drumming a fiendish tattoo on the solid, stony countenance, heroically scarred, of the good city.

Aircraft Has Eliminated Surprise Tactics

The great surprise of aircraft in the present war is that it eliminates surprise. The public does not appear to understand the changed conditions of warfare that make this possible. Fed on daring exhibition tricks and keyed up to a point of idiotic expectancy by newspaper writers with a taste for prophetic pronunciamento rather than for facts, the public has evinced mostly disappointment, whereas military men have shown enthusiastic approbation.

There have been plenty of epoch-making events on the aërial frontiers of this war, but incompetent correspondents, unable to grasp the nature of their significance, have reported them incompetently. The public has been cheated of its right to be properly informed on aërial tactics in warfare.

Not only has the air scout reduced the proudest cavalry to second place in the matter of reconnoissance, but he even prepares the way

for it. In addition, he precedes and picks the terrain for the armoured motor-car squadrons which an invading force deploys in advance of the cavalry. He does this work so efficiently that scouting reports, which formerly required days by the speediest cavalry, are now delivered in a few hours and in a much more thorough and detailed manner. If this were all the air scout had accomplished on the firing-line, any military commander would commend his retention for the mere speeding up of tactical intelligence.

But this is by no means all. Air scouting is indispensable in many other directions. For "close-in" reconnoissance over the fighting lines, marking changing positions, intrenchments and reënforcements, and for extended reconnoissance, especially on the wings of the army to guard against turning movements, the air scout is doing a work of paramount importance to the commander where cavalry could not follow.

For swift courier service, where galloping hussars were formerly employed, the air scout is now used. For aiding in obtaining the range for the artillery, and continually correcting the

same to insure accuracy of fire, the air scout is invaluable. For spotting the enemy's artillery, which is usually masked, and dropping smoke bombs or tinsel signals indicating the position and simultaneously aiding in establishing the range, only the air scout can get results. For detecting the enemy's line of communication and raiding it by bomb attacks, and even for transporting explosives and detonating railroads and bridges, the air scout shows up bravely. In fact, the work he has done, and is doing, in this war, on all these points is of a character so remarkably thorough and efficient that he has influenced measurably the strategy of opposing commanders and compelled tactics that were never tried before.

The present war has amply shown that the tactical deployment of a modern army is more absolute than relative; that is, once the formation of the battle-line has been decided upon it is there to stay, and though it is subject to rearrangement this requires much more time nowadays than formerly. The battle front on the Franco-Belgian borders has ranged from 150 to more than 200 miles in length, with little less than 3,000,000 men strung out in opposing lines.

It is evident that such tremendously extended formations cannot be quickly changed in the main plan—though changes in detail are effected with much greater dispatch than formerly—and therefore it has become vitally necessary to plan the disposition of the battle-line with hitherto unknown care and sagacity in advance of actual fighting.

This necessity has increased the task of the commander-in-chief to a point where the science of conducting warfare on land is beginning to resemble naval warfare. Instead of being more or less in the dark as to the forces opposing him, as in the days when scouting was done by cavalry only, the commanders in this war know exactly what forces they are facing, the same as a naval commander knows by observation the kind and number of vessels he is likely to engage.

And thus it comes about that on the modern battle fronts where opposing forces know each other's strength and disposition at all times, the same as in a naval battle, it has become practically impossible to execute movements intended to ambush or surprise any considerable division of an army. What is the practical

cause of this momentous change in field tactics? If it is not due to the "eye in the sky," what is it?

By the medium of air scouts the commanders in this war have not only been able to accelerate tactical operation in detail, but they have been kept *à jour* constantly on the strength, position and movements of opposing forces, and by virtue of the exact information thus reported they have been enabled to dispose enormous masses of troops over huge areas with greater and closer application of scientific strategy than ever before in the military history of the world.

Three months' fighting has shown that it is not so much actual superiority of numbers that counts as the ability to oppose the enemy in the decisive encounters with forces superior not only in number but in quality. Owing to scouting facilities being practically equal on either side, concentration of large bodies of troops is immediately detected if undertaken in daytime and as certainly counteracted. Forced marching under cover of night, then, and motor transport of troops to some extent, have become the only means whereby a com-

mander can move upon the enemy at break of dawn with superior forces.

The very fact that the Germans appear to possess a higher degree of "nocturnal" mobility, and are trained to execute this manœuvre in large units, is what gave them the initial advantage, more than any other factor, and enabled them to drive the Allied armies before them almost to the gates of Paris.

The air scout also affects the method whereby field commanders execute their final orders. The risk assumed by possible misjudgment is so great, owing to the extended firing-line, that no commander would venture to make a decision until all the air scouts assigned to his division have filed satisfactory reports. If the reports do not tally, or if more definite and detailed observation is necessary, the modern commander chooses to wait rather than guess his way through, and he can afford to wait, for the air scout makes waiting, in an emergency, only a matter of minutes where cavalry would consume hours. This is particularly so in tactical reconnoitring when the hostile forces are, in most cases, not marching on the roads but are concentrated in trenches or deploying either

to form new lines or to occupy new positions prepared for them during the night. These last-minute changes and eleventh-hour dispositions on the enemy's part are what the commander is desirous of knowing above anything else. It is a matter of minutes. His air scouts bring him the facts and necessarily with considerable personal risk, for in tactical reconnoitring the air scout cannot locate and estimate the half-hidden troops except by getting down close somewhat within range of rifle-fire. True, a machine or two is often lost in a venturesome errand of this sort, but the loss is small compared to what the disaster would be if there were no aëroplanes and squadrons of cavalry were to wade in and try to find an enemy who is waiting for them in trenches with rifles! One single "eye in the sky" can observe the formation of an entire army corps more accurately and with less risk, and in much shorter time, than a whole squadron of cavalry. It must not be assumed, however, that I am in favour of diminishing the cavalry; on the contrary, I believe, the present war will compel an increase in the cavalry arm generally. There is plenty of evidence that aërial reconnoitring

is much more effective when supported by cavalry than when independently conducted. The air scout is better fitted to observe than the cavalry, but the latter is better equipped to take quick advantage of his observation than any other arm, and particularly in the important and difficult screening movements on which the main force of modern armies is forced to rely to a much greater extent than formerly. So far as actual field experience in this war would seem to indicate, the most decisive results have occurred wherever air scouts have operated in conjunction with cavalry assisted by mixed cycle corps of motor and leg-propelled vehicles. In other words, maximum results are best obtainable when the most mobile sections of an army can be made to combine and concentrate on reconnoissance duty requiring extreme rapidity backed by the instantaneous *offerte* of sabre and rifle. The "eye in the sky" for discovering and observing a hidden enemy, the "mounted" sabre for outflanking him and pushing home an attack over ground where only horses are efficient, and the "motor-infantry" for deploying a flying wedge over the highways —this seems to be the ideal combination for

reconnoissance requirements in the present war. The Germans appear to have made use of it liberally in their premier advance, when men succumbed to machines and too strenuous pushing had the effect of a serious reaction, which served to help the Allied resistance.

When it comes to actual fighting the performance of the air scout has disappointed only the laity who have been led to suppose that bomb-dropping aircraft would somehow supplant the artillery or at least supplement it. Aërial bomb-dropping is still in the experimental stage, despite certain notable advances, and no military man expects much from it except as a destructive auxiliary against hostile aircraft bases and the like. Here and there a lucky shot has caused not inconsiderable damage, but until more accurate means of placing explosive bombs have been adapted to present types of aircraft their offensive strength will remain negligible. This also applies to the Zeppelin dirigibles. Although these craft can carry large stores of heavy, explosive bombs, they do not seem to be able to hit a target properly, even when the target is as large as the vital spots in the cities that have been bom-

barded. On the other hand, it must be admitted that the Zeppelin is the only type of craft which is adequately equipped to fight its logical and immediate enemy—the aëroplane, whereas the latter has no effective means of attack against the Zeppelin except the very uncertain factor of surprise, and then only by concerted action.

But the crowning achievement of aircraft in this war is that while three million trained troops have been locked in a death struggle for months halfway across Western Europe, it is due to the superb reconnoissance of air scouts that not a single instance of ambush or flanking turn of consequence has taken place!

What the Zeppelins Have Done

Why have not the Zeppelins done more? is the popular cry. Why don't they sink the Franco-British fleet, why don't they bombard naval and military bases; if they are what is claimed for them, why don't they do something worth while?

Indeed, the Zeppelins have been active intermittently, only the Germans have not thought

it necessary to report their secret operations for the entertainment of newspaper readers. Under cover of night Zeppelins have preceded every important move *en masse* of the German armies. At early dawn they have observed the movements of the Allied armies without themselves being observed. They have sailed around the rear of the Allies and long distances beyond the rear, noting the oncoming of reënforcements, the ever-changing position of the various lines of communication, the preparations made for the defence of a line of forts, the manning of intrenched camps, the location of commissariat bases, etc. They have reported what they have seen by their own long-distance wireless, and they have returned to their hangars loaded with fresh detail information accurately mapped out and ready for use.

Invisible and noiseless, these huge, swift nocturnal birds of the German forces have placed their commanders in a position to know almost as much about the enemy's doings in the main as the enemy himself under conditions *when aëroplanes would have been detected and probably destroyed.* It must be remembered that a Zeppelin can well afford the time necessary to

ambush itself successfully in the clouds if only for the chance of an occasional peep through the rifts. Similarly, a Zeppelin can hover in fog and mist and wait till it clears, when it *rises aloft together with the mist,* completing observations as it rises, so that its blue-gray contours are not visibly revealed against the overhanging vapours. One notable difference between aëroplane scouting and Zeppelin reconnoissance is that the latter is more thorough and remains undetected in most instances while the former invariably betrays its presence. There is a decided advantage in being able to collect information when the enemy does not realise that his plans have been read, and there is little danger of his changing plans in this event.

We are in the habit of discussing Zeppelins unmindful, or perhaps unaware, that there are at least two classes of this craft with points of divergence which may be cause for surprise to the laity. Whenever Zeppelins have been referred to in print during the past, the designation is applied to the old, and now partly obsolete, type of aërostat with which the public is generally familiar. A small complement of this

craft were told off for service on the French frontier and in attendance upon the Baltic and North Sea fleets at the outbreak of the war. Whatever reports have seen print up to this writing have related almost wholly to the exploits of the Pre-Zeppelins.

As to the latest improved type—the Super-Zeppelins of the German aërial fleet—it must be stated that they are not included in the official lists nor are they gazetted in even the military archives of Germany. In common with the motor-driven siege mortars and the field howitzers, both of enormous calibre, and the new naval artillery now being installed on the battleships, they belong to the secret armaments which Germany has succeeded in preparing during times of peace for warlike emergencies of the present calibre. Only a few special officers of the German General Staff know anything about the Super-Zeppelins, outside the working crews and the aëronautic architects, and these men are specially sworn in and vigilantly watched to insure complete and permanent secrecy. By dint of diligent spy work, however, certain interesting particulars are now available, but I am not prepared to vouch for

their accuracy, though they are more than plausible and well worth printing.

The Super-Zeppelins are supposed to be an improvement on the latest known type designated "L III," which displaces no less than 32,000 cubic metres and is capable of maintaining an average cruising speed of fully 63 miles per hour on extended expeditions of upward of one and a half day's duration. Against this remarkable record the Super-Zeppelins will show an improvement of at least 5 miles in speed and 12 hours additional staying power. What this would mean can be gleaned from the performances of the "L III," officially attested to, which covered 1,300 miles in 36 hours in a circumnavigation of Germany's strategic borders, keeping the while in constant rapport by wireless with its base at Friedrichshafen, at distances sometimes approaching 500 miles! The "L III" can illuminate any target on land or sea with its 40,000 candlepower searchlight from an altitude of 4,600 feet, or just barely beyond the effective range of aërial cannon. This margin is improved in the Super-Zeppelins, which can place fully a thousand feet of "safety" space between their keel and the ver-

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French Zouaves repelling a German air raid by means of an anti-aerial field gun. Man in rear is operating the range-finder. Man standing by gun is loading; man kneeling under gun is sighting and firing.

tical range of aërial artillery; and while thus hovering they can reveal any target below with searchlights and discharge bombs. The latter are also a distinct advance upon the known type such as were tried out on the city of Antwerp. Instead of being mere capsules containing explosives the bombs of the Super-Zeppelin will be armoured projectiles capable of penetrating the deck of the strongest battleship or the concrete base of a fortification. They will be exploded not on contact like the present form of bombs but after penetration, on the delayed-action principle. In other words, the explosion will not have the effect of a grenade, which seldom causes real havoc except among massed troops, but it will have the character of a detonating mine. A well-placed shot detonating in the concrete of a fort, after penetrating the same, entirely aside from the personal damage it may do, will wreck the range-finding apparatus and prevent the fort from aiming its cannon correctly. A projectile bomb of this type would have no difficulty in piercing the armoured deck of a Super-dreadnaught. As little as 50 pounds of dynamite—to mention the least destructive of mod-

ern explosives—detonating in the vitals of a battleship, from a vertical aim, will cause a good deal more havoc aboardship than a heavy naval shell piercing the side armour horizontally. Bombs weighing 120 pounds have been dropped by Pre-Zeppelins. The new projectile for Super-Zeppelins will be considerably heavier, and as many as ten will be carried in the magazine of each craft, or more than double the ammunition needed to destroy a battleship, assuming there would be at least one bull's-eye for every miss. The Germans have secretly experimented with aërial range-finders for more than two years. Owing to the war privilege of utilising the patent files *ad libitum* they have now in their possession at least one method of launching bombs, personally known to the writer, which should enable them to hit a battleship at will, and, in fact, a very much smaller target.

Where the "L III" craft mounts machine guns in the gondola and atop the gas envelope, the Super-Zeppelins will have special rapid artillery of superior range and protected against rifle-fire by shield-barbettes. Even the envelope is tinted a vague blue-gray similar to

the field-uniforms of the German troops, which makes detection an exceedingly difficult task. Moreover, the drums contained in the various chambers of the envelope are filled with a recently perfected kind of gas said not to explode even by contact with exploding shells. The fabric used for the drums has improved elastic and adhesive qualities, so that any ordinary rent or tear will partially heal of itself. The gas feed is arranged so that quite a number of drums would have to suffer leakage before the loss of buoyancy would be serious and compel the vessel to rely on her engines entirely for impetus sufficient to steer her out of hostile range.

It is authoritatively admitted that the secretly made Super-Zeppelins, of which Germany is credited with upward of a dozen, are being especially fitted for an attack not only on British bases but directly against the British navy. It is to be doubted, however, if Germany could produce such a squadron entire in time to deliver a decisive blow despite her far-reaching secret advance preparations. Nevertheless, even if we grant this point it is apparent to any military mind that even a single Super-

Zeppelin skilfully handled stands a first-class chance against a fleet of battleships in blockade formation. And if we go even still further and grant, for argument's sake, that the aërial dreadnaught will not succeed in sinking a naval dreadnaught, even the most prejudiced mind must admit that the offensive activity of such craft in the act of dropping bombs on hostile naval vessels will be a harassing factor of conspicuous aid to simultaneous action of the German torpedo and submarine flotillas. While the experimental factor looms large in these aspects, sound judgment would take into account such practical possibilities as momentarily choking the gunners on naval vessels by dropping gaseous bombs to windward of their position. By such tactics it would not even be necessary to hit the ships so long as a series of bombs could be exploded on the windward side, for the fumes of the gases would be prodigious enough to penetrate the turrets and barbettes and nauseate or choke the gunners. Even if the effect would be only that of inducing a vigorous sneezing on the part of the crew the advantage thus gained might be a decisive factor, for even the most adept of gun captains

could not be expected to adjust his sights to the range given when convulsed by fits of suffocation or nausea! We must not forget that entire gun crews have been asphyxiated instantly by the explosion of gaseous charges, during several artillery encounters in this war, and if troops can be choked to death by horizontal fire, sailors can at least be set sneezing by vertical fire!

One reason why the Zeppelins have not as yet taken the offensive against the Allies' armed defence may be found in the fact that the Germans thought it more expedient to acquire some practical experience in the handling of these novel craft over hostile ground before actually engaging hostile positions armed for repelling them. There are quite a few things which the Zeppelin pilots must learn that can only be learned in actual hostile encounter under war conditions. Before the pilots have gathered a certain amount of experience in these respects they might be led to assume greater risks than the vulnerability of their craft would warrant, and the loss of a Super-Zeppelin, entirely aside from its high cost, would be too serious to gamble against guesswork tactics.

A single item should suffice to explain the

situation: in the matter of target practice, both horizontally with machine guns and vertically with bomb-dropping apparatus, the Zeppelin commanders have little to learn, and in manœuvring against the elements their pilots are quite sufficiently trained.

It is in the plan of attack and in the plan of retreat that practical experience is most urgently wanted. Not that the Zeppelin pilots have no such plans, but it is not known to what extent these plans, which have been worked out to cover every conceivable exigency on the aërial fighting line, are useful or whether actual war experience would disclose means of improving them. The pilots of aërial dreadnaughts have yet to learn the best method of approaching an enemy ready for them with squads of aëroplanes and aërial cannon, and they must also learn the best way to retreat under fire. In attacking, should the ship rise to its highest altitude and take up a hovering position in the sky while aiming its bombs, or should the approach be made on the lowest altitude dictated by safety and the bomb-dropping conducted while the craft is travelling full speed in an ellipse over its target?

In conducting a retreat from hostile rifle and cannon fire, is it better for the ship to take its chances on rising vertically to its maximum altitude or would it be preferable to go full speed ahead on the horizontal while gradually climbing to greater heights? These are questions which only actual fighting can determine with the weight of finality.

The temptation of the Zeppelin pilot will always be to seek the lowest safe altitude to insure accuracy of observation and aim, but this very tendency is what makes the Zeppelin a target for attack, if not by aërial guns, then by hostile aircraft.

In fighting the latter a flock of aëroplanes would never have to encounter an attack by a Zeppelin, as an attempt of this sort by the latter would cause it to be surrounded by some of the aëroplanes even if it could shoot down a few of them before this would happen. The Zeppelin's only recourse would lie in flight under full speed, keeping always a few hundred feet altitude power in reserve for a sudden dash skyward. While thus flying before its enemies the Zeppelin would have the immense advantage of being able to direct a murderous and continu-

ous fire from its machine gun batteries—that is, from a solid, steady platform—against its pursuers before the latter, in most cases, could deliver effective fire, since the platform from which they would shoot is one that is subject to violent vibration and is never quite steady for a moment.

War Beacons That Steer the "Eye in the Air"

A circumstance which has tended to give Germany's dirigible fleets the advantage of unusual mobility and security of base is an excellent system of aëronautic signal lights and beacons. Between its eastern and western frontiers Germany has a network of beacon stations that enable her sky pilots to steer a straight course at night and proceed undetected to the point of reconnoissance without exposing themselves to observation. Germany has more than a score of such beacon stations, by means of which she can move her entire aërial corps at all points of the compass, or transfer them from one frontier to another in a few hours. France has entirely neglected this very important branch of military aëronautics. The first German experiments in

this field proved that a searchlight throwing a cone of light upward could not be seen at long distances, contrary to expectation. Neither did the plan to identify the beacons by means of coloured slides work out well, as it was found that light projected by them suffered by absorption. For marking the landing-places and the aërodromes or hangars coloured lights were found to be very practical, however. The eventual result of these and similar field experiments was that the German flying corps succeeded in evolving a first-class working system of beacons with landing lights of use for both military and naval aircraft. The searchlight plan was discarded and beacons were erected resembling the lighthouses in use for marine navigation. These beacons are of three kinds: to wit, the flash, the fixed and the revolving light, but instead of operating upon the horizon as in lighthouse practice, the aërial beacons operate vertically upon the atmosphere of the sky. In a class by themselves are what the Germans call the Morse beacons, thus named because they are constructed to translate into perpendicular flashes the dots and dashes of the Morse telegraphic code. Thus,

the Morse beacon known to German military aëronauts as "Mark 45" reports its position by short and long flashes as follows: xxxx xxxxx o xxxx xxxxx. The type of landing lights finally agreed upon as the most desirable are embedded in the ground and protected by a huge glass cover, very thick and strong, on which aircraft land directly and are brought to a full stop. The arrangement of the lights also very cleverly serves in signalling the aviator the direction of the wind while effecting a landing. In the centre of the landing base is a large square white light. Some distance from this centre, about 75 yards, are four red lights designating the points of the compass—N. E. W. S. A weather-vane is connected electrically to these lights, so that should the wind blow N.W. the north and west red lights burn in addition to the white base light in the centre. Should the wind turn the vane around to S.W., the lights signalling N.W. are automatically doused and only the red lights south and west would show. In case the wind dies down to a dead calm, no red lights are visible, and only the white light in the centre shows. By these very simple and positive means the

German pilot, whenever compelled to fly at night, is at all times able, on picking up a beacon, to tell exactly where he is and how he should steer to make a clean landing in case he wishes to descend. The largest aëronautic light in Germany is the Weimar beacon, which has no less than 27,200,000 candlepower behind its huge revolving flashlight situated atop of the military aërodrome. The tallest light, that is the light placed at the greatest altitude, is the Grosser Feldberg on the Taunus range, which projects a fixed shaft of light of 800,000 candlepower from a crag situated over 2,800 feet above sea-level.

Protecting Airship Bases

In this branch of military aëronautics the Allies have made the mistake of depending entirely on the searchlight. Experiments conducted in Germany have proved quite conclusively that nothing is easier to avoid during nocturnal reconnoissance than the vague pencils of a searchlight battery. Their penetrative efficiency is a known factor, and the only precaution necessary is to fly above the altitude

they command. Moreover, they aid hostile aircraft after the manner of beacons whereby to steer, and at the break of dawn, when reconnoissance becomes most effective aboard a dirigible having selected her position to this end under cover of night, the searchlight is, of course, useless. The French army, while based on the barrier forts between Toul and Belfort, was treated to a pretty severe lesson in this regard when a French dirigible, announced in advance by wireless, could not be picked up by the multitudinous shafts from the searchlights on the forts.

The German plan of protecting aërial bases is thorough and practical. The main defence is stationed on elevated points commanding the base in a wide circle and equipped with special aërial Krupp cannon and machine guns. This artillery is supported by powerful searchlights, which makes it possible to pick out hostile aircraft and simultaneously blind them as soon as they get within bomb-dropping range. In other words, the aërial base is protected by a zone of rapid artillery fire issuing from bastions distributed over a wide area, and at a commensurate altitude, so that any hostile object entering

this zone will be subject to cross-fire. In cases where the aërial base contains an aërodrome, the dirigible within leaves its housing at nightfall, and takes up a position at an altitude supposedly greater than that which hostile aircraft must steer to make an attack on the aërodrome effective. Between the dirigible hovering noiselessly and unseen in the clouds beyond range, but capable of picking up any intruder with its searchlights and focusing rapid fire on it, and the terrestrial bastions blazing away from below, hostile aircraft would not have much chance to do any real damage before they would suffer annihilation themselves.

Those who wonder why France, reputed to have the most numerous and efficient air fleet in the world, has not shown any noteworthy disposition to raid German aërial bases, especially at night, will realise the hazards involved. So much more can be accomplished by skilful reconnoissance, at least during the commencement of hostilities, than by destructive tactics that neither the Germans nor the Allies have been quite willing to risk their aërial equipment on sanguinary knight-errantry of this sort.

Aëronautic Auxiliaries

The very latest development in aëronautic auxiliaries includes motor war transports for aëroplanes, and motor field-repair shops for the same. While France and Germany have made creditable progress in this line, it has remained for Russia to produce these auxiliaries in units comprising motor-trucks pulling aëroplane trailers supported by motor-driven aëronautic field-repair shops. The duty of the motor-truck is threefold. It must pull the trailers containing the aëroplanes, it must carry and quarter the officers attached to the aëro squadron, and it must serve as a lazaret for them on the field. Each of these two-ton motor-trucks is completely equipped for this triple duty, which enables an entire aëro division to proceed, at a good rate of speed, to its base with machines and men and repair facilities in one compact unit. The trailers are so constructed that the aëroplanes can be loaded merely by folding or detaching the planes. The repair-shop is mounted on a three and a half-ton chassis propelled by a thirty-horsepower engine, and its

machinery is intended for manual as well as electrical operation. The equipment is very practical and includes every necessary implement from anvil and smithy to lathe, miller and carpentry tools. For rapidly repairing aëroplanes as well as automobiles on the firing-line, such a repair shop on wheels is invaluable. It is one of the very useful auxiliaries which is not "mentioned in dispatches," but it is doing a great work behind the smoke of battle in this war.

Opposing Aërial Forces Compared

Although France had more than a year's start of other nations in the race for aërial armament it remained for Germany to beat her and surpass her during the last three years. At the outbreak of this war, Germany had the advantage of an aërial fleet superior, not only in constructive merit and practical equipment but also in organisation and personnel, to that of France, her keenest rival.

The reader has probably already perused the statistics given out as official and published widely by an unsuspecting press. Let it be said once for all that these statistics, while they

are official in a popular sense, are more remarkable for what they are intended to hide than for what they are supposed to give. Counting the machines owned by the army, and such as have been commandeered into service, Germany probably went to war with fully 600 aëroplanes of all kinds. But this figure does not represent her actual flying strength. Nowadays the manufacture of aircraft has been standardised, which in turn admits of large numbers of machines being made with great rapidity. There are upward of thirty aëroplane factories in Germany that went to work on a night-and-day rush order basis at the call to arms on specifications previously completed by the Imperial Flying Corps. This tremendous effort, supported by the emergency stock of motors and spare parts always carried by the government, has enabled Germany to increase her aëroplane arm, during several months' fighting, until she has now fully one thousand machines in service.

Most of these additions, it will be found when the smoke of battle clears away, will adhere to a type of craft which may constitute a surprise the same as the secret Krupp and Skoda artillery. The Grand General Staff has an admi-

rable system providing for the manufacture, during times of peace, of parts and accessories that demand great time and care, such as motors, chassis, propellers, etc., so that when the bugle sounds it is largely a matter of assembling, rather than manufacturing, additional machines. The staff calculates its work on the theory that about sixty per cent. additional craft is required in a war on two fronts, as at present. It is also staff policy to settle in advance, so far as practicable, which of modern improvements ought to be acquired for the government with a view to keeping them secret so that a quite considerable proportion of the mobilised aërial forces may have certain special advantages over those of the enemy. As technical improvements in aërodynamics and aërostation are chiefly supplied by military engineers, Germany has experienced little difficulty in maintaining technical secrets intended for use only in so far as they remain secrets.

In Zeppelins, Parsevals and other dirigibles, Germany had twenty-four craft in service at the call to arms, capable of an average speed of 48 miles per hour. At this writing she has managed to complete at least three partly finished

Super-Zeppelins with the prospect of finishing an extra squadron of these formidable aërial fighters—probably not less than nine craft—before February.

Against this dazzling equipment France makes but a poor showing. Although her military programme calls for seven large swift aërial cruisers of 24,000 cubic metres to be delivered in January, 1915, none have been completed and only three are in process of construction. The other French dirigibles, of which there are sixteen of all kinds, from the unwieldy Astra craft of 1,000 horsepower to the Zodiac toy-vessels of 110 to 220 horsepower, are so far inferior in speed, cruising range and offensive capacity to the German dirigibles, that it is futile to draw comparisons.

In the aëroplane arm, France is much better equipped. Although fully 1,000 machines have been acquired by the French Government since 1911, it is quite safe to say that only half of this number meet the requirements of modern war efficiency. But France has more aëroplane factories than Germany, and she ought to be able to increase this her only effective aërial arm even more rapidly. One thing is likely to

interfere more than anything else. France lacks the thoroughgoing system and masterly organisation that characterise everything the Germans undertake to do.

Russia has the ideal "paper" armada of the air. The official statistician credits her with a neat, round 500 machines, and some "official" lists add an extra hundred to this number by way of good measure! Undoubtedly this total has been arrived at by computing the customs receipts including all aëroplanes imported to Russia since 1910 for both private and military use. If Russia can actually muster one-fifth of her boasted aërial strength she will have a good deal more than I would be prepared to vouch for, and the Germans should be able to shoot down their antiquated craft at will. The only item of interest in Russia's aërial development is the Sirkoski giant machines, of which only four are completed. This native type of monster biplane possesses several not uninteresting and meritorious features, but it is more remarkable as the probable forerunner of what will eventually constitute a troop-carrying aëroplane than for any feature of practical warlike use against existing craft. As

many as sixteen soldiers have been carried safely by a single Sirkoski machine at low altitudes, however, where they would soon change into corpses if carried on the firing-line. Of dirigibles it is unlikely that Russia can have more than two fairly modern craft in commission. These vessels are of the French Astra type and of little consequence anyhow.

England is much better equipped with aircraft than is generally believed. Having borrowed most of her constructive ideas from France, England has, nevertheless, succeeded in producing a native type of aircraft which is remarkable for excellence of workmanship, especially the seaplane. She is credited with a total of 300 aëroplanes, but even if commandeered machines are included in this estimate, it is probably more than twenty per cent. exaggerated. Small as this force is compared to those of France and Germany, it has given a good account of itself at the front, chiefly in reconnoissance work and raids on German aërial bases. The care with which the Royal Flying Corps has undertaken to train pilots as well as observers has proved an object-lesson to France no less than to Germany. In dirigibles,

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The "Eye in the Sky" that climinates surprise tactics. ABOVE *is the latest type of French military "avion," capable of a speed of 125 miles per hour.* BELOW *is an automobile aeroplane hospital, containing every requisite tool and appliance for repairing aeroplanes on the field of battle.*

however, Great Britain makes a sorry picture. Seven slow and rather old-fashioned non-rigid airships of various kinds is all she can muster, but these vessels are powerless to manœuvre in bad weather and will probably not be taken to the front. A half-dozen improved non-rigids are building, capable of negotiating 45 miles an hour, and, if finished according to plans, these ships should be able to join the colours in January. Unless convoyed by a squad of armed aëroplanes it would be fatal to employ such craft for reconnoitring over hostile territory.

Belgium has a miniature aërial corps chiefly consisting of French aëroplanes manned by French-trained pilots, and it requires no imagination to understand how typically Belgian this is; but vivid imagination is requisite to see in the ancient and honourable gas-bag labelled "Belgique III" the semblance of aërial efficiency.

Austro-Hungary has two passenger dirigibles of the early Zeppelin type, which are available for military purposes, and three non-rigid dirigibles belonging to the army. Small as this squadron is, the Dual Empire has already benefited greatly by it, in a tactical sense, as its border enemies have nothing of consequence to

oppose against it. In aëroplanes, however, Austro-Hungary is the weakest of the great powers. She can have little more than a score of modern machines at the front, unless Germany has been thoughtful enough to loan her a squadron of fliers.

The activity displayed during the last few months in the way of mobilising the aërial arm is well-nigh stupefying. In dirigibles alone Germany lacks only three of equalling the combined strength of France, England, Russia and Japan, according to the latest obtainable official figures; and in aëroplanes the Allies have not been able to exceed by more than eighty machines the total increase of Germany since the first shot was fired. The score is as follows:

DIRIGIBLES

	Mar.	Aug.	Jan.
Allies	43	51	64
Austria and Germany	39	48	69

AEROPLANES

Allies	..	2700	3380
Austria and Germany	..	1400	2000

The Austro-German increase in dirigibles is practically concentrated in a tremendous output of Zeppelin craft of the marine type, undoubtedly with a view of torpedoing the British blockading fleet from above as it has been torpedoed from below hitherto. Another point that has been elucidated since hostilities commenced is that aëro-scouting is not nearly as fatal as it was assumed to be. The casualty rosters show that the percentage of killed and wounded in the military and naval aëro corps is lower than that of any other arm.

The Advance in Bomb-Dropping

The lay impression prevails that the dropping of bombs from aircraft has proved rather failure than success. The layman instinctively compares bomb-dropping with artillery fire, unaware of the fact that the former is not intended to replace or even complement the latter. The greater weight of projectile, and its superior striking velocity on impact, added to the rapidity of fire and inexhaustible supply of ammunition, are the advantages of terrestrial artillery

which no system of aërial artillery can be expected to duplicate.

In a military sense the aërial bomb is intended partly as a demoralising factor and partly as a destructive agent under isolated conditions where no other means of inflicting damage can be brought into play. To be sure, the latest Super-Zeppelins carry a store of heavy explosive projectiles which would cause havoc comparable to that of heavy field artillery if dropped with accuracy of aim, but that does not imply that they are supposed to carry the burden of the artillery. A fleet of such craft attacking massed formations of troops in the enemy's rear, beyond the artillery's range, could without doubt at times cause destruction similar to what the artillery is capable of within range. Nevertheless, such a coup-de-main has not been essayed so far in this war, the ostensible cause being the risk of forfeiting part of the aërial fleet, which is more urgently needed for larger and more ambitious operations.

There are many different kinds of aërial bombs in use, but they are all similar in that they explode on contact with a terrestrial object. Hence, the damage caused is in most cases

no more serious than that of a large hand grenade and generally far less than exploding shrapnel. That such would be the case in actual war was foreseen by the writer as early as 1910, when he joined in collaboration with Lieutenant R. E. Scott of the United States Artillery, in evolving a new type of aërial bomb, which would be more destructive than a grenade, equal to shrapnel, and detonating like it by time fuse, and, on demand, quite as effective as a mine exploded in the earth under the enemy's position. The outcome of this collaboration was an apparatus with means for launching heavily armoured explosive projectiles from aircraft in motion, the launching device actuated by an aërial range-finder to insure accuracy of aim. The entire apparatus weighs but 26 pounds and is installable alike in dirigibles as in aëroplanes. The ammunition consists of 15 projectiles weighing 18 pounds each and fitted with steering vanes to insure their steady course through space and striking head on without tumbling. The mathematical problem involved was that of suiting the range-finding to a quick and accurate determination of the parabolic curve which the

projectile is forced to follow, impelled by the speed of the aircraft; of finding speed of the latter in relation to earth, and means of estimating windage on the projectile after launching. Two years' experimenting enabled us finally to produce an apparatus which in 1912 fulfilled the above requirements well enough to win the great Michelin Prix Aëro Cible of 150,000 francs under the auspices of the French Government and the Aëro Club de France. Our apparatus, which is the pioneer of all bomb-launching machines, not only defeated all similar devices entered by other pilots representing the efforts of various nations, but attained the remarkable score of making eleven bull's-eye shots in a target only ten yards in diameter from an altitude of more than 2,500 feet, the aëroplane going at a speed of about sixty-five miles an hour against a stiff breeze. Rendered into the favourite allegory of the newspaper writer, the aëroplane was speeding as fast as the Empire State Express at an altitude more than thrice the height of the Woolworth skyscraper, and buried eleven armoured projectiles in a target about as large as one of the funnels on the *Mauretania*. Despite this performance—which

France took pains to herald as a French victory!—it was very difficult for us to convince the general staffs of Europe's leading powers that we could sink war vessels as readily as we could explode fortified places and rout encampments! It was not so much the men as the red tape wound around the men. Before the present war is fought to a finish the powers that hung back in 1912 may desire to adopt the device in 1915.

The points of divergence I wish to emphasise are that the Scott-Dewitz apparatus is the only one produced, to my knowledge, which launches not an ordinary bomb, but a self-steering projectile that can be loaded as a shrapnel and detonated like one, of additional use either as an incendiary missile spreading flame on contact or as a gaseous agent distributing nauseous fumes; and, finally, as an armour-piercing weapon burying itself in the vitals of its target, detonating after penetration, on the delayed-action principle with effect similar to a mine exploded in the ground.

It is clear that destruction wrought on these lines is formidable in the extreme and much more positive than explosion by contact.

A system quite different from the above is that invented by Steinmetz for both aërial defence and offence. The defence is provided for by a field of aërial mines, shaped like miniature captive balloons anchored by wire contact with the earth at altitudes where they will interfere with aircraft and explode their charges on contact. This plan of "mining" the air is patterned upon the anchored contact mine of naval warfare, but unlike the latter it is neither invisible nor impervious to currents. The only practical use of air mines would seem to be limited to the nocturnal operations of hostile aircraft, and as they can be set very quickly in rows distributed over various altitudes they should offer fairly good protection even if they tangle and premature explosions are caused by wrecking in a stiff breeze.

Somewhat more problematical is the Steinmetz offensive plan, which has been adapted from the ancient and honourable method of catching fish by means of a line and hook. Only in this instance the line is a light wire wound on a reel and the hook is a small hand-grenade. The inventor now proposes to go fishing for aircraft in the heavens in a very speedy aëro-

plane by overhauling his quarry and "hooking" it with the pendent bombs. I do not say that a number of swift aëroplanes fitted with this simple tool could not succeed in pulling a wire over a dirigible and exploding the charge, but in order to capture a 65-knot Zeppelin, for instance, the aëroplane must be not only unarmoured but unarmed in order to insure a superior rate of speed and expert handling of the reel bomb. This means that the Zeppelin would have an excellent chance of shooting down its assailants before the latter could hope to overhaul it. A Zeppelin thus attacked would invariably seek its highest attainable altitude and speed away from the attack. As it can rise at the rate of more than 2,000 feet per minute, and maintain a horizontal speed of 65 knots, the approach of the aëroplane to a fleeing Zeppelin cannot be more menacing than at a rate about 30 miles per hour, that is, allowing a speed of 96 miles for the aëroplane. At these speeds, the aëroplane must fly a distance of 7½ miles in 15 minutes before it could overhaul and snare the Zeppelin. During the first five minutes, the Zeppelin would have ample time to get the range and adjust its rapid-fire artillery,

to maintain a zone of fire, a continuous stream of bullets focused on the aëroplane. During the ensuing ten minutes, the latter would be compelled to fly 4.7 miles against a zone of murderous machine-gun fire totalling probably not less than 4,000 bullets per minute. If anybody thinks the aëroplane has a chance, let him lead the attack. It is only in exceptional instances as when a whole squad of aëroplanes could manage to swoop down out of a protecting curtain of cloud upon a Zeppelin at rest, and take it by surprise before it could get under momentum and operate its guns, that the Steinmetz outfit could be considered in the light of a practical aëronautic equipment. But it appears to me it could be employed with more certainty in "hooking" wireless stations, on incendiary raids against hostile hangars, and for harassing lines of communication.

CHAPTER II

AUTOMOBILE ARTILLERY

Firing a "Brummer"

They who dwell in the pleasant valley of the Sambre, where the ornate border-posts of Flanders salute the forts of France, are seized by the spell of its autumnal revelry. Last September saw nature on the Sambre in the same mood, but the Flemish goodmen and goodwomen failed to respond.

The harvest moon stood in the sky like a festive, round-faced peasant glowing with anxiety, but there was no harvest anywhere and there was no festive greeting from the earth peasant to the moon peasant.

Devastation, stubble-fields and devastation.

The causeway flanked by double rows of grenadier poplars has lost not a few of its giants by shell fire. Some of the trunks are snapped clean off as one would break a match; others are splintered as by thunderbolts. The poplar column ranges through a village slain to bits with heavy shell fire and consumed by flame. The empty village lane is gutted with débris and broken masonry. Bits of shattered glass gleam

in the moonlight. Charred timbers and beams grope with rusty spikes against flame-seared walls. A solitary chimney stands aloof, veined with cracks, like a wounded sentinel intent on his duty. What was before a quaint little place now turns toward heaven a crippled, mangled corpse of charred bone and pallid brow in mute witness of the horror of war.

Out on the causeway a lonely figure strides up and down—a Prussian picket in gray with spiked helmet. A half-mile further on another sentry and so on at intervals along the fine, old pike toward Charleroi.

A buzzer sounds. The picket bends down over something by the roadside and picks up a concealed receiver. "Jawohl!" He has his orders. A squad of military engineers approach him presently. They are "pioneers" and carry lanterns doused in buckets. With pick and spade the crew begins to blaze a trail through the field, paving it with heavy wooden planks. Quickly, silently and smoothly work the pioneers, pushing the planked trail ever further until it pierces the forest fringe. And there, in a small glade, also working by lantern light, is a crew of masons and artificers erecting bomb-proofs and laying a heavy concrete base in a circle.

A large, long shaft of light breaks upon the horizon on the east bank of the Sambre. An-

other huge shaft cuts in on the west bank. The shafts sweep out slowly searching every inch of ground. Presently they meet and focus on a spot somewhere in the southwest in the direction of Fort Maubeuge,—the prelude to a Prussian night attack.

Again the buzzer sounds; again the picket snaps "Jawohl!" There is a dull, rumbling sound, barely audible. Shooting it is not. Thunder it cannot be, smiles the moon.

Closer and closer comes the rumble, and as the picket peers along the murky highway he discovers a huge, unshapely monster ambling forward with the tottering pace of a barbarian idol on wheels. It snorts and blows and growls. It gnashes steel tooth against steel tooth. Sparks of lightning flash from its monstrous eyes. Onward it trundles ponderously like a menace to mankind.

It comes to a halt before the picket. The canvas is removed and a big 42-centimetre "Brummer" stands revealed gleaming in the moonlight. With its three heavy recoil cylinders tucked around the monstrous barrel it looks like a quadruple cannon pointed to shoot down the foolish moon.

The crew jumps off the motor-tractor, which is detached. The pioneers bring up a team of forty-eight artillery horses, and the heavy piece is skidded and limbered onto the wooden trail.

The drivers spur on their teams, and the big "Brummer" moves forward tumultuously over creaking planks to its base on the big concrete patch hidden behind the forest fringe.

The platform base is bolted down, the mountings and cylinders are set in place, and the barrel is backed up and cradled in its sleeve of steel. Pistons are snapped into gear, handwheels are set spinning, levers are pulled, the ton-heavy side-breech clicks open to the touch of the hand, and the pawl of the turn-table gear begins its metallic chatter as the big gun is being whipped into battery. There is a decade of inventive technical skill behind every move completed, behind every part and piece of the huge machine. It responds to its code of mechanical adjustment with the precision of a soldier at drill. A sharp command sends the crew into the bomb-proof. The big piece is loaded and ready for the range.

With the first gray shimmering of dawn there is a dull, droning sound overhead—the air scout speeding out for final reconnoissance. A bugle calls the gun crew to quarters. Soon the air scout returns, signals and sweeps away to his post of observation several miles beyond the enemy's trenches, where the steel-turreted ramparts of Fort Maubeuge hide in the morning mists.

The crew, not employed in firing, lie down on

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The Belgian S.A.V.A. turret automobile, so called because it "has a rapid-fire gun mounted in a cupola-formed revolving turret, besides a heavier gun in the turret proper, and it is equipped with huge headlights to operate at night also"

hands and knees; even the gun-captain crouches apprehensively! The buzzer sounds three quick taps, then a long "F-e-u-rrr!"

There is a blast as of an exploding volcano. A hot flash blinds and gags the crew. A disintegrating crash convulses the earth. And twelve hundred pounds of deadly projectile goes screaming and howling through the air in a vast arc over the Prussian front beyond the Franco-British trenches, beyond their rear, and knocks a monstrous hole through twenty feet of steel and concrete, breaking the crest of the fort impregnable and slaying the crew in one vast explosion.

The shell has travelled over six miles. The gun has not moved an inch.

Making the "Impossible" Possible

Because non-technical writers are freely permitted, and even invited, to express opinions on technical subjects there is now, in this country, widespread confusion on many military topics. The belief that the big gun is the biggest factor in deciding modern battles is a case in point. The success of the secret German heavy artillery of the howitzer and mortar type, which promptly reduced French and Belgian forts considered impregnable, is largely responsible for this delusion. To to sure, artillery of the Krupp 42-centimetre type is a tremendous asset to an invading force obliged to cut its way through miles of barrier forts against which ordinary field cannon is comparatively ineffective. But when these big pieces have done all they can possibly be expected to do in the way of destroying a fortified place, it still remains for the infantry to advance and hold the ground thus gained, as otherwise this advantage would soon be lost. Also, while the heavy projectiles of the

Krupp mortars can devastate any modern fortification no matter how strong, and at the same time destroy the garrison, heavy firing, no matter how long continued, cannot completely rout the enemy, who would deploy anew on the cessation of firing in case hostile infantry should fail to advance and hold the terrain bombarded.

The principal difficulty in bringing heavy artillery into action is the slow and laborious manner in which it must of necessity be advanced, coupled with the danger of losing it to the enemy in case the advance intended cannot be completed. Hence, the field artillery of a modern army consists mostly of small-calibre cannon of the direct-fire type, and the object of the artillery commander is to make up for the want of extra-heavy ammunition by rapidity of fire and accuracy of aim.

This is a basic requirement in the armies that are now warring. Those of Germany and Austria are the only ones that have been successful in introducing a new departure by designing mortars for field service that outclass even the heaviest naval artillery, at least in calibre, and of quite astounding mobility despite great weight and unwieldy

ammunition. What was impossible before is not only possible now but a demonstrated success owing to the inventive capacities of the Skoda and Krupp arsenals. Not only can the Kaiser's armies take heavy artillery to the front, and keep it moving up and down the front at a very creditable pace, but the metal thrown by these giant pieces is of such preponderating calibre that the destructive effect of a 42-centimetre battery practically equals the broadside of a modern battleship.

All this would have been impossible were it not for the skill with which motor traction has been applied to furnish these modern artillery monsters with the requisite degree of mobility. A decade ago, even had the Germans been ready, their big guns would never have seen the front. Motors were not powerful nor reliable enough then to do the traction work. The guns would have been platformed in steel forts and their excellent offensive capacity lost to the German invading armies. It would take a team of thirty-eight to forty-eight horses to pull a 42-centimetre piece over the prevailing terrain, and relays would be required every four hours to keep the big gun moving apace with a march-

ing army. This would require at least 114 horses for each piece, and means slow transportation if everything goes without a hitch, which it doesn't in warfare.

All kinds of curious estimates are current anent the monstrous Krupp 42-centimetre pieces, which German soldiery has variously nicknamed "Brummers," because of the growling note of their report, "Tanten aus Essen," because of their origin, and "Dicken Luders," because of their squat and stout proportions.

One military "expert" even goes so far as to state that the piece weighs 124 tons, fires a 1½-ton projectile costing $9,500 apiece, has a barrel length of 69 feet, a maximum range of 28 miles, and glibly fixes the total cost of this mechanical monster at the modest figure of $462,000! In the absence of authentic specifications why not draw a bit on the imagination? Another similarly accredited "expert" abruptly denies the existence of the gun. He regards it as a myth, arguing that according to the rules of artillery construction, which allows three feet length of barrel for every inch of bore, the gun would be 51 feet long and weigh 34 tons, and, of course, he adds, such a monstrous piece

is not transportable in the field! A third critic, and an alleged eye-witness at the front, corrigates all preceding guesses by announcing, with the air of finality, that the Austrians, not the Prussians, are the chaps who have placed the big guns at the front, "none of which, however, are of more than 30.5-centimetre calibre and no larger than the standard siege cannon in Russia's army." In the absence of facts it is quite remarkable how certain people regale themselves with conclusions. Once they have shaped for themselves a theory, no matter how weird, they have no difficulty in finding or manufacturing "facts" to fit the theory.

It is quite true that the well-known Russian Putiloff arsenals several years ago designed a heavy field-piece, based on drawings and specifications obtained from Creusot of France. The gun proper weighs 6 tons, the carriage and mounting about 28 tons, and it is calibred to 30.2 centimetres, or about 12 inches. This piece was designed more for siege requirements than for field operations, to which its low degree of mobility is not likely to suit it, and it is for all practical purposes more of a mortar than of a cannon.

Some Big Gun Blunders

Soon after war was declared the Skoda works in Austria, practically the equal to Creusot in artillery technique, sent a battery of 30.2-centimetre howitzers to be tried out in comparison with the 21-centimetre field and the 28-centimetre siege howitzers of Krupp make. These are the three types of pieces that finally reduced the chain of forts defending Liège and Namur to fragments, but as the maximum calibre was held by the Skoda guns some observers got the notion into their heads that Austria furnished the big guns and not Prussia. It was not until the army of General von Kluck crossed the Meuse and the bombarding of Fort Maubeuge began that the "Brummers," the 42-centimetre Krupp automobile mortars, were allowed to decide the issue, hence the confusion in terms and calibre by "veteran" war correspondents *et al.*, most of whom are unable to tell a recoil cylinder from a barrel.

It may also surprise the reading public to know that up to the present time of writing, or about one hundred days of warfare, the alleged

Krupp 42-centimetre cannon that have been so elaborately photographed and vociferously heralded in the newspaper and periodical press are not at all German guns but Austrian 30.2-centimetre howitzers of Skoda make. It must be admitted, however, that only a military expert could tell the latter type apart from the German 28-centimetre siege howitzers, but neither type comes within range of secret armaments as they are published as standard equipment in the official lists of both countries.

So far, the writer has not seen a single genuine photo of the real German "Brummer" of 42-centimetre calibre, and until one of them is captured we are not likely to encounter it in print unless a war correspondent is willing to forfeit his life for the sake of entertaining his readers.

Nevertheless, it may be asserted with comparative certainty that the secret 42-centimetre pieces do not differ materially from the standard 28- and 30.2-centimetre pieces except in weight and ponderosity. In general, all three types may be classified as heavy siege automobile artillery, since they have main features in common. The transportation problem is

effected in three units. First, there is the automobile tractor, which carries the artillery crew and tools, and furnishes the motive power. Second, a car with the platform and turn-table for the gun including the mounting, the sleeve and the recoil gear. Third, a car specially designed to carry the barrel or gun proper. On level roads a single tractor is sufficient to move the three units at a good speed, but where heavy grades interpose a tractor is needed for each car. It is a mistake to assume, as some writers do, that such an outfit of heavy automobile artillery can race up and down the firing-line and select bases of operation at will. It can do no such thing. When military men speak of the unusual mobility of these guns they mean that they possess a greater degree of mobility for the enormous weight carried than was possible before. At best they can maintain a pace on average country roads corresponding to the double-quick of an army on the march, which is quite sufficient for modern artillery needs. The initial transportation of the gun from the arsenal to the army base is undertaken by rail. From this base to its predestined position in the rear of the firing-line, the gun proceeds under

its own tractive power, that is, it follows the country roads as close up to this position as possible. The most difficult manœuvre of the whole journey is to move the gun from the highway across the field terrain to the position plotted for it, or, to use a military term, to get the gun in battery.

Getting a "Brummer" in Battery

If the ground is soft or uneven, the army pioneers are set to work constructing a temporary road over which the big gun is then hauled by teams of from thirty-eight to forty-eight horses. When the ground is passably firm the gun proceeds under its own power or assisted by horse, as the exigencies may dictate, but even so there are obstacles in the way of stone fences, ditches and soft spots that must be dealt with by the pioneers before the big gun can be limbered into place. In some cases the heaviest mortars are shipped direct by rail to their emplacements, aided by specially laid side tracks. Once this object is gained a heavy concrete base is laid and the platform with turntable and mountings emplaced in it solidly.

Then the car bearing the barrel is backed up to the platform, and the barrel is fitted to the double recoil cylinders on the mountings and drawn forward into the sleeve. The piston rod of the recoil cylinders is bolted to a lug attached to the breech, the barrel is elevated into position, and the big "Brummer" is ready to sling a ton-heavy projectile a distance of seven miles and smash any defence as yet devised by the human brain.

Some people do not understand the function of a piece of artillery at the moment of being fired. They think the gun jumps back the same as a rifle kicks back. Were this so, neither accuracy nor rapidity of artillery fire would be possible, and a 42-centimetre piece would wreck itself by a single shot. The only thing that changes place at the moment of firing is the piston in the recoil cylinder moving back with the gun proper as it slides in its sleeve or cradle. There are three cylinders running parallel with the gun barrel. The middle cylinder does the braking actuated by a recoil spring, and the left and right cylinders are merely for air storage. All the cylinders stand fast; it is only the piston of the recoil cylinder that jumps

back with the barrel of the gun at the point of firing. The training gears on the mounting give a swift and positive elevation of upward of sixty-five degrees, and also permit of sweeping the gun quickly through a horizontal arc of five degrees on either side of its longitudinal centre. Of course, the entire gun with platform and mounting can be swung completely around by means of the turn-table fixed in the base.

The Austrian 30.2-centimetre Skoda gun throws an explosive projectile weighing close to eight hundred pounds a distance of more than six miles, firing at the maximum range at 42½-degree elevation. The weight of a complete gun outfit is thirty-nine tons. On this basis it is safe to say the 42-centimetre Krupp piece ought to be able to hurl a 16-inch shell, weighing more than a ton, fully seven miles. What this means can perhaps better be appreciated when we say that no super-dreadnaught built, once within range, could withstand the onslaught of such a battery. It is not likely, however, that the Germans may adapt their 42-centimetre mortars to naval requirements, and equip a number of battleships with this formidable arm.

Every now and then a writer pops up with a lurid tale showing that Germany is approaching her finish because her heavy cannon are worn out and the gunners have gone crazy! As usual the guesswork expert straddles the wrong steed and comes a cropper. It is precisely the big guns of the "Brummer" type that suffer least. The explosive strain is much less in a gun of the howitzer and mortar type, such as the German and Austrian "Brummers," than in a direct-fire type of cannon to which naval and field artillery in general belong. When naval men say that the main batteries of a modern battleship can be fired an average of only two hundred rounds—and this applies to 12-inch and 14-inch pieces—they mean not that it is dangerous to fire the guns, though the factor of safety is rapidly reducing after the two-hundredth round, but that the guns are becoming inaccurate and difficult to serve. Of course, every shot fired by a cannon means a certain microscopic injury to its rifling—erosion is the artillery term—and continued injury of this kind will gradually bring about certain defects in the rifling that make good marksmanship impossible. While erosion is more

prevalent in large guns than in small guns, and, of course, least in the army rifle, this applies only to direct-fire weapons which require intense muzzle velocity of projectile to be effective. The indirect-fire artillery, to which Skoda and Krupp howitzers belong, is not menaced by erosion to any considerable extent and can keep up comfortably with the army rifle. As to the crews getting crazy under the strain of serving the batteries, this is all poppycock. To be sure there is a factor of fatigue to be considered, not only in metals but in men. The latter wear down and the former wear out. For this very reason the big gun crews are relieved as much as possible, and the arsenals at Essen are busy day and night to produce new batteries of "Brummers." If gunners are getting crazy, it must be those who are getting the big shells about their ears rather than those who are aiming them.

When Repairs Might Win Battles

The really serious side of the artillery problem, on the firing-line, is how to provide for renewals and repairs of the active guns. On

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Here is the gun that has been featured everywhere as the "terrible German 42-centimeter cannon." As a matter of fact, it is a field howitzer, corresponding in caliber to a 12-inch mortar.

the present fighting fronts these pieces have been under high pressure requirements for several months, and by the time this book may see print they will be pretty well worn; at least they will be so worn as to be inaccurate. The commander who is farsighted enough to provide for this eventuality, and has means at his disposal to maintain an uninterrupted process of repairs and renewals of active field artillery, will have a tremendous advantage over the commander who waits till he is forced to do it. A factor of this calibre, which most laymen would ignore, might easily become one of particular moment, especially if the war is going to last the winter out.

But tenderer and more difficult to maintain than rifled field cannon are the motor-tractor, the armoured automobile, and the motor-service cars in attendance upon the artillery corps. The rough handling that these vehicles are of necessity subjected to on the front increases the factor of depreciation to a point where only extraordinary repair facilities backed by adequate renewals could possibly maintain the efficiency of the motored vehicles. Here is another chance for long-distance generalship. It isn't

so much who has the most and the best cannon and motor-artillery now as who can keep them best and most numerous till the last great battle of this war is fought to a finish.

At the outbreak of this war Germany had some four thousand guns in the field artillery, not counting secret armaments, against three thousand owned by France, almost two thousand under the Austrian eagle, considerably more than four thousand under the Russian knout, and little more than a thousand pieces on John Bull's side. Of this artillery it is quite safe to say that Germany and Austria have their full combined quota of six thousand pieces actually in the field. The only one power of the Allies that has all its guns out is France, and deducting the guns that Russia and England have saved for other purposes, we find that the Allies are superior to the Austro-German forces by little more than eight hundred pieces. This should be more than offset by the heavy siege howitzers of Skoda and Krupp make, and the capacity of these works for rapidly manufacturing new artillery in huge quantities. With more than eighty thousand hands working in double shifts night and day the Skoda-Krupp

combination, added to the twenty thousand men employed by Erhardt and other gun-makers, are most certainly in a position to outdistance the combined efforts of the Russian Putiloff, the French Creusot, and the British Armstrong and Vickars arsenals.

One of the most potent reasons why German strategy chose the Belgian route for invasion in preference to blundering into the trap so cunningly arranged by the French at the "trouée d'Epinal" on the Toul-Belfort barrier, is that the highways in Belgium, and those connecting the Flemish border with Northern France, are more level than elsewhere on the frontier, and thus better suited to the transport of these heavy Krupp and Skoda pieces without which von Moltke could not have ventured to order the storm-drive toward Paris. Reducing modern steel forts by siege methods is a slow operation, but von Moltke was well aware that in the secret Krupp and Skoda heavy artillery the German army had the nucleus for quickly destroying even the stanchest forts of the enemy, and, moreover, artillery mobile enough to keep pace with the forced marching of the German army.

Armoured Automobiles

The armoured automobile is the "cavalry" of motor-driven artillery. In mobility it is superior to horse, but more susceptible to breakdown and unable to swerve from the beaten path of the highway. It has offensive power superior to both infantry and mounted troops, but lacks their capacity for concerted and continuous action. Mainly for these and similar reasons the work detailed to the armoured automobile in this war has been limited to reconnoissance duty involving extraordinary features not hitherto encountered in warfare. For quickly driving a wedge into hostile territory in advance of an invading force, making observations under speed, and, whenever compelled, to attack and disperse with rapid artillery such detachments of hostile troops as it may run across, there is no weapon comparable to the armoured automobile. Fighting on the frontiers has shown that such machines reach their maximum value when operating in conjunction with air scouts, that is, the scouts can usually direct them to the vital spots and warn them of hid-

den danger. When the terrain is wooded, however, or in case of misty weather, the air scout can do nothing of importance, but a muffled armoured car can sneak through and complete the scouting where mounted men would be detected if not decimated.

When Germany invaded Belgium the American press was forthwith flooded with accounts of how the Germans advanced in endless columns of armoured cars! Marching belongs to a former epoch, the soldiers of modern armies are carried to battle in armour-clad automobiles—that was the sweeping impression conveyed. Of course, nothing of the sort occurred. The German army regulations provide that an invading force be invariably preceded by its active field officers. They must look over the terrain and select positions for the advancing army corps. These officers are sped forward in light armoured autos, complete their observations as rapidly as possible, and return to their post. Several such motor-scouting squads shot across the Luxembourg and Belgian borders at the commencement of hostilities, but they consisted of officers, not privates, and only officers are thus transported. Marching is obligatory as

ever, and once the men are in the trenches forced marching orders under cover of night are not infrequent.

The motor-cars used for high speed scouting purposes are armoured but not armed. There are no guns mounted in the cars. The rifle is the only weapon employed. The plating is very light—seldom of more than four-millimetre thickness—and just sufficient to turn rifle and machine-gun bullets. The German Opel and N. A. G. cars of this type have a vertical steel blade attachment at the front for cutting such wires as the enemy may stretch over the roads.

In the Minerva military model the Belgians possess another successful type of armoured scout. It is very similar to the light German scout, but is armed with one rapid-fire gun and plated with five-millimetre steel. It has neither hood nor cupola and the crew inside are supposed to protect themselves by ducking behind the armoured walls. The Belgians also have a heavier model of S. A. V. A. make, which is equipped with huge headlights to operate at night also. This car has a rapid-fire gun mounted in a cupola-formed revolving turret,

and although it is supposed to be an improvement on the Minerva type, it has not operated as successfully as the latter.

When it comes to "armoured forts on wheels," Germany and Italy divide honours. The Mercedes and Opel trucks mounting five to seven Krupp rapid-fire artillery, plated with half-inch steel armour, and having solid-tire disk wheels, are virtually miniature mobile forts, but they are not very speedy. An even more formidable fighting machine is the Isotta Fraschini heavy model produced by Italy, which boasts a battery of four rapid-fire guns and has a revolving turret not unlike that of a Gruson fort. England seems to depend chiefly on commandeered vehicles, and her subsidised, armoured Daimlers are disproportionate in number to the needs of her army.

France appears to have done comparatively little fighting with her armoured cars, though she possesses in the Schneider and Charron at least two types that are considered models of their kind. The Charron is the only completely inclosed armoured car that affords the crew an unobstructed view on all sides through steel-lattice panels, and even the wind-shield is made

on this plan. A revolving cupola mounting a single 5-centimetre gun tops the car, and the appliances for training the gun and the cupola are very complete. Despite its weight and heavy equipment this car is quite speedy, having pneumatic tires, which, strange to say, are left unprotected by shields.

The Schneider type of armoured car is chiefly noticeable for its "superimposed" turret, that is, the lower part of the turret is stationary and the upper part is rotating. By an ingenious arrangement the gunner can sit on a seat attached to the gun and pedal a bicycle crank, which moves the gun with the rotating upper half of the turret cylinder. The gunner has both hands free—and this is an advance over other systems—but as he is actually sitting on top of the gun at the moment of firing he is liable to a good deal of shaking up.

The experience gained under fire in this war would seem to discourage the further building of excessively armoured and comparatively slow cars in preference to speedy cars clad with plates of medium weight and armoured with one or two machine guns. To appear suddenly, to maintain a withering fire for a while, and to

disappear suddenly, these are the capital fighting assets of the armoured automobile as far as this war has taught. The extra-heavy, slow-moving, heavy-gun cars do not appear to have done what was expected of them.

An instance in point is the invasion of the Belgian town, Alost. Instead of sending a flying column through the streets, which were heavily barricaded and filled with snipers in concealment, the Germans wedged in with a small squad of light-armoured automobiles fitted with machine guns. In a short time the streets were cleared, and more than fifteen hundred Belgians were mowed down by the murderous motor artillery. Probably a corresponding number of Prussian troops would have been killed by the barricaded Belgians had the armoured cars not been employed before the investment of Alost took place.

The "Super-Brummer"

As to the 56- and 60-centimetre German "Brummers," which the American newspapers have so insistently heralded under scareheads like, "Guns to Shoot into England," and "Guns

to Shoot over Twenty-one Miles," I am sorry to say I have no information. If such guns have been at all produced they must of necessity be of the indirect-fire class known as siege mortars, and I doubt if they are transportable by motor traction. Their use, if they appear at all, will be confined to siege operations, and for establishing fortified bases on the Franco-Belgian coast for German torpedo and submarine craft. Besides, the maximum distance at which the range-finder ceases to operate, owing to the earth's curvature, is eleven miles' range.

When we consider that it takes fully a year to produce a 30.2-centimetre gun and that six months must be added for one of 42-centimetre calibre, it is quite evident that neither Germany nor Austria could at this time have quantities of such heavy artillery unless they had started to manufacture in series years ago. As the machinery requisite to the making of these artillery monsters consumes fully a year to produce, and does not maintain its efficiency for long periods, it is clear that the time required and the difficulties encountered are such that no other nation could expect to compete with Ger-

many in this arm within the epoch of the present war. So far as I have been able to gather, the first German "Brummer" was laid down in 1909. At a subsequent trial at the proving ground the gun was pronounced a "failure" officially. Owing to the huge calibre this was readily believed by the military world, which then and there dismissed the idea of a possible development. This is what the Germans wanted, and forthwith they began to manufacture "Brummers" by the dozen, keeping the secret so close that only the highest officers of the Grand General Staff knew what was going on underground.

How the Heavy Shooting Is Done

Judging by the questions I have been asked since the war began there must be a lot of people in this country who are not aware of even the rudiments of modern artillery practice. They cannot understand how it is possible for the artillery gunner to fire at an object not visible to him and yet hit it.

What is termed "indirect" firing is a method of reducing artillery practice to mathematics,

which all modern armies have adopted, chiefly owing to the enormous range of modern cannon. Of course, this applies also to the artillery propelled by motor traction.

The "indirect" system means that a battery of howitzers and field-pieces can stand in a valley and shoot over the top of a hillside, dropping shells upon an enemy hidden from sight in a forest several miles distant. Artillery officers are required to be expert at geometry and trigonometry, for upon the triangle is based the application of the system. The officers take their post some distance away from the battery and usually on the tallest available eminence. If aëroplanes are operating in connection with the battery, they do the "spotting" not only of the enemy's position, but of the shots as they strike in his direction. One point of the triangle is represented by the officers' post, the second is the battery, the third is the enemy. The distance between the officers' post and the battery is called the base line. This distance is measured. The angles at both ends of the base line are figured. This done, it only requires a trigonometric operation to determine the actual distance of the enemy, and

this is called "finding" the range. From the officers' post word is given over the field telephone to the gunners of the battery informing them of the accurate degree of elevation and the exact point of compass necessary to reach the target. These adjustments having been made, the command "Fire!" is given. From their point of vantage, the officers observe the effect of the shot. If changes in the range are necessary, owing to faulty observation or the movements of the enemy, the field telephone carries the instructions promptly to the gun captains. A battery thus masked in a depression does not betray its position except for inconspicuous puffs of smokeless powder, and it is only by close-in aëro scouting that its exact place on the map can be ascertained.

Whenever the enemy succeeds in thus spotting a battery an effort is generally made to move it during the night unless the battery is holding the post for reënforcements. Here, again, motor traction is an invaluable aid. While the enemy is preparing to take the battery by assault at dawn, the battery has been motored away to a concealed position, sometimes miles distant, and the first news the enemy gets of this

nocturnal manœuvre is usually a sudden shell fire sweeping his trenches from an altered angle.

Actual War Automobile Strength

When we analyse the numerical automobile artillery strength of the powers now at war we must not permit ourselves to be misled by the way in which military statistics are compiled, as they vary in different countries. With 250,000 trucks and cars and more than 200,000 runabouts and motorcycles at her command, Great Britain would easily seem to predominate, but, as a matter of fact, she has fewer army cars fitted for service than France, and quite a considerable proportion will remain in England for home defence. Less than ten per cent. of her motor lorry division—a scant 1,800 cars—have been landed in France, and most of these are for commissariat purposes. Not a single armoured automobile was in the lot. Later on, a few were improvised. Moreover, the British cars have caused much trouble and confusion as they cannot use French parts and accessories and are poorly provided with these from home. These

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The Belgian "Minerva" model is a "successful type of armored scout." It is very similar to the light German scout, but is armed only with one rapid-fire gun and plated with 5-millimeter steel. It has neither hood nor cupola, and the crew

circumstances have not tended to give the English army standing at the front in the automobile arm.

With 100,000 passenger cars, 25,000 motor buses, taxi-cabs and motorcycles, and 10,000 motor trucks of all kinds available for military use, France was able to give her transportation and commissariat great initiative and well-maintained endurance. She has several squads of automobile aëroplane cannon and armed autos of the Schneider and Charron models. In armoured artillery she has confined herself to batteries of 12-centimetre and 15.5-centimetre Rimailho howitzers. As there are 21 batteries of the latter type of gun in the French army, and four pieces in each battery, France would make a very presentable showing in automobile artillery provided all batteries are motor-driven, which is to be doubted. The only advantage secured appears to be increased mobility over the horse-drawn cannon; the French have not understood how to combine greater offensive power with greater mobility like the Germans.

It is quite curious that the power with the numerically strongest army—to wit: Russia—

should be least efficient in army automobiles. There are less than 600 trucks in the Empire. Orders for almost double this number have been placed abroad recently, chiefly in this country, but it is a question if delivery can be made in time to make the cars effective.

The combined Austro-German forces possess the strongest and best equipped automobile war outfit by far. The Dual Empire has 1,400 trucks available for army use and about 20,000 passenger cars convertible to the same use. A small squad of motor tractors for the heavy Skoda howitzers and light-arm automobiles armed with rifles and machine guns, complete the contingent. Germany has not only fully 15,000 convertible passenger cars, but quite as many delivery vans and trucks, besides 1,200 subsidised military motor vehicles with trailers. On the offensive end, Germany went to war with some 250 armoured automobiles, 18 searchlight motors, fully 10,000 motorcycles, and at least 500 motor-driven field-guns, not counting a squad of extraordinarily powerful motor tractors for the transport of the big Krupp 42-centimetre howitzers in the field. In addition, there are several squads of aëroplane repair

automobiles and motors with powerful searchlights for use in night attacks. At the call to war the government commandeered no less than 60,000 passenger cars. A number of these were told off for the commanding officers, adjutants, orderlies, etc., in order to give the greatest possible mobility to every move affecting the disposition of the army, but the majority of these cars were used to move troops on the firing-line under cover of night. When it is considered that it requires only 510 passenger cars to transport a German regiment on a war footing of 3,000 men, and that an entire army corps can be moved at an average rate of 20 miles per hour at night with a fleet of 7,140 motor cars, it will be understood why the Germans have been able, in most of the decisive encounters, to outnumber, or at least equal, a numerically superior enemy.

French vs. Prussian Cannon

Many have asked me if it is true that German guns are inferior to French guns. That such a detail can still stick in American minds shows that "incidents" of the Balkan wars, as

interpreted over British cables, are likely to yield erroneous impressions.

Stripped of technical phrase, the French field cannon is more of a gun than the Prussian—the same as a Swiss watch is more of a veritable timepiece than an American movement. The latter will keep time just as unfailingly, nevertheless, and it will stand careless handling much better. It is easier to repair and cheaper to buy. A Krupp field cannon has parallel characteristics. It withstands rough usage better than the French Creusot rifle. The powder employed does not injure the rifling so rapidly under continuous fire; it does not get out of order so easily; it has fewer parts and is so thoroughly built that explosions (at least officially attested to) are unheard of.

The Creusot rifle is a piece of high art gunmaking. It represents generations of excellent craftsmanship and the best traditions of artillery practice. It is the quintessence of the armourer's art and an object of admiration in all technical detail. Properly handled, it is doubtless a degree superior in efficiency to the Prussian piece—at least on the practice range—but an artillery artist is required to serve it

properly. In the heat of battle this does not matter so long as there are enough gun artists to go around.

In the hands of French gunners, the Creusot is the finest piece of shooting mechanism ever invented, especially the 75-millimetre model, corresponding to a 3-inch gun. Operated by French-trained Bulgar gunners it scored markedly over the Krupp pieces poorly served by incompetent Turkish artillerymen.

When the smoke of this world-war clears away I dare say the verdict will show for the Krupp rifle, as handled by Prussian gunners, quite as high percentage of efficiency as the Creusot piece operated by native artillerists.

CHAPTER III

THE SUBMARINE

A Submarine Attack

The haze of early dawn broods over the bight of Helgoland. A pale and chilly sunrise peeks cautiously over the Friesian dunes outlining the crags of the island fortress crested with cannon. Slowly the pale beams filter through the vaporous curtain lifting a cover in places like a "hausfrau" making up her bed.

The sea sleeps calm and frigid like a great, undulating jelly sealed under a blanket of haze. The stillness is oppressive, ominous.

It is broken at intervals, but not relieved, by gruff, muffled thuds from the inner harbour—from the dim, hidden distance of warlike mystery and menace. Were it not for the portly, rubicund buoys that gasp and cough their warning notes, swaying lazily in the tide, one would fancy a school of sea-lions barking a salute to the sun.

Beyond the cordon of buoys, a row of painted poles sail in the inlet marking the channel that is loaded with anchor mines. The poles are

bobbing gently up and down like floats in some giant's fishing tackle.

One of the poles seems to be drifting away from the line. It is of a dark-gray colour. Curiously enough it moves against the tide leaving a thin, keen wake of froth, and is lost to view in the haze. Faster and faster the pole travels; sharper and sharper waxes the wake.

Under the runaway pole, hidden safely below the sleeping surface, stands a man in a conning tower. His eye is glued to a periscope. To the right and the left are speaking-tubes, dials, gauges and levers. He is the commander of that most dreaded of all naval craft, the submarine, the stiletto of the high seas.

Except for the intense drone of the electric motor there is no sound within the steel skin of the great mechanical fish. There is no splashing of water against the sides, no wave motion, only the tremendous pressure of the ocean depths, and the "crusher" gauge shows it.

The chief gunner stands in the torpedo breech, in the prow, clasping the central hand-wheel. A fling of this wheel and all the torpedoes dart away simultaneously. Other men stand by other wheels commanding port and starboard torpedoes for single shots. The quartermaster is posted at the wheel control of the horizontal rudders intent on gauges showing the inclination degree and depth level of

the craft. His movements are curbed to the fraction of an inch; he works as carefully and minutely as a jeweller—an awkward move of the wheel means disaster to all hands. Shoulder to shoulder with the commander is the helmsman, his eye on the compass, his hand on the wheel steering the vertical rudder.

Back in the stern is the chief engineer with his assistants standing by switches and levers, cocks and valves. This is a "split-second" crew, ready on the instant to stop or reverse the motors, to disconnect them altogether or start the gasoline engines in place of them, to blow out or force water into the ballast tanks, to draw oxygen and expel carbonic gases, to load storage batteries, to tend compressors, to watch pressures in pistons and chambers, to make quick repairs when necessary—to do more engineering and do it efficiently, in the smallest and compactest engine-room ever devised, than was ever done before.

Conversation is forbidden. Martial discipline governs every action. Speech is reduced to words spoken in the performance of duty. The electric lights are so arranged that the tools and appliances needed are distinctly visible. Everything is in its proper place from the potash cartridge chamber that absorbs the foul air to the refuse ejector that blows waste out into the water. At the ear of every man is

a speaking tube. From the officer in the turret comes an occasional command—a wheel is turned, a lever is moved, a switch is thrown—and the big mechanical fish continues its daring course, gliding through hostile depths dotted with floating mines and ploughed by the swift forefoot of a hundred cruisers whose smallest gun could send the dauntless diver to the bottom with a single shot.

Availing itself of the haze, the submarine ventures to the surface and runs awash at its cruising speed of 16 knots until the British coast heaves in sight, when the course is laid N.E. At six bells in the afternoon the lookout at the omniscope signals a fleet of fishing smacks on the port bow. The helm is laid down and the big mechanical fish bears down upon the dowsed smacks. The haze has cleared. On the fringe of the horizon is a spot, a dark spot getting ever darker and bigger. With his binoculars fixed in the periscope the officer gleans the blurred outline of three large funnels belching black smoke.

There is a sharp command. The gas engine stops. The speaking tubes commence to rattle with words of command—sharp, precise, staccato—answered by the quick "Aye—aye, sir," of the crew.

The commander takes an observation, the distance between the enemy is measured mathe-

matically, the course is laid by compass, the rate of speed is timed to the distance, there is a rapid inspection of all gears—and the final dive is ordered.

The engine tube speaks. At once the electric motors strike up, sending the craft on its course. The trimming tank tube speaks, and hand-wheels are set spinning as the forward tanks blow their ballast. The quartermaster has already clasped his wheel. The tube talks and he digs in with a gleam in his eye. The dial of the inclinometre shows how smartly he is pointing the craft on its downward dive. The chief gunner is at his post in the torpedo breech. Presently his tube speaks. He spins a small wheel, a piston snaps with a hollow thud, and the war-head of the torpedo chamber clicks into fighting trim, pointing three savage-looking missiles at the enemy.

And thus to the hum of throbbing motors, punctuated by snapping pistons, speaking tubes croaking with commands, the war-head gleaming with torpedoes at the ready, the mechanical fish plunges through the foaming brine downward to its fighting level of twenty feet below the surface, bearing down upon an enemy it cannot see with uncanny precision,—relentless, irresistible. Availing itself of the fishing fleet as a screen, the submarine is able to take one more peek over the surface without being de-

tected by the enemy, which develops to be a super-dreadnaught.

The experienced eye of the commander observes at a glance that he shall miss his target unless—the emergency command rings out: "Starboard helm! Forward trim!" The submarine destroyer swerves from its course, rising at the same time to a somewhat higher level. By this manœuvre her commander hopes to cut the course of the immeasurably swifter dreadnaught, and intercept her before she can pass—"Port torpedo—ready!" rings the tube. A great, monstrous shadow comes bearing down upon the little craft. With incredible swiftness it approaches, seeming almost to draw the craft toward it with the suction of its menacing bottom. The plunging bilge keels are visible now. A collision means death, not only to the dreadnaught, but to the destroyer as well. Just as the great armoured ram of the ponderous hull, ripping through the foam, gaunt and grim with barnacles, seems to aim a deathblow at the little craft, the main tube in the torpedo breech screams: "F-e-u-rrr!" A handwheel spins, pistons click in the war-head, there is a hollow pop as of a huge cork being pulled, and a glittering torpedo, charged with superheated energy, darts out, cutting the brine at a mile-a-minute clip. Submarine distance is always deceptive; the dreadnaught is fully a cable length away.

"Starboard torpedo—ready—Fire!" follows the command. But before the second missile can cut the water there is a thunderous explosion. The whole forefoot of the huge warship is lifted clean out of the water. Before its yawning freeboard is buried in the swirling foam, the second torpedo knocks a hole amidships, exploding her magazines with the roar of an erupting volcano.

The huge leviathan of armour-plate and giant gun, fleet as a scout, strong as a fort, representing twelve million dollars in the mint of the realm, and nine hundred lives in human flesh and bone, has been scrambled into a horrible, tottering wreck—steam whistles screaming for help, boilers exploding like a field of mines, flames bursting from hatches, masts snapping in two, monster cannon rousing their turrets overboard, the crew jammed like squealing rats in a hundred traps, lashed by jets of scalding steam, the scuppers oozing blood like the nostrils of a wounded bull. In short, a capital ship, the pride of the proudest navy, has been vanquished by a small marauding craft, looking very like a mechanical fish: a little marine toy, a poor skate of a craft, engineered by a boat's load of dare-devils, the joke of naval mess-rooms and sometimes derisively referred to as the "tin sardine."

The Submarine Is Vindicated

If you had laid a wager on August 5, 1914, that it should be possible for a single German submarine to send to the bottom three British armoured cruisers of 12,000 tons each, scoring a bull's-eye with each of its three torpedo tubes, and escape unhurt and intact, you would not have found any takers, least of all among naval officers. The consensus of expert opinion would tend to show that whereas a lucky shot might bag a carelessly manœuvring cruiser, the accuracy of naval gun-fire is such that the submarine would forfeit its existence on the second, or, at all events, on the third attempt.

As all the world knows, Lieutenant Otto Weddigen, commanding the "U 9" of the German submarine flotilla, worked his way through hostile mine fields and actually accomplished the "impossible." The attempt of the British Admiralty to minimise this most brilliant and daring raid by explaining that the cruisers torpedoed were "obsolete and of secondary im-

portance" is a bit silly in view of the fact that the same Admiralty took occasion to plume itself on the "victory" of the English squadron in the engagement of Helgoland Bight when three German scout cruisers of one-fourth less tonnage and one-half the weight of armament carried by the "obsolete" British cruisers were defeated by an overwhelming force including battle cruisers!

Another German submarine slipped through the deadly British mine fields at Deal, daring the naval blockade of the combined Franco-British fleets, and boldly navigated up to within a mile of the English coast, where it torpedoed and sunk the mine-sweeper *Niger*. That, also, was "impossible"—before it was made possible!

A third German submarine boldly attacked a squadron of three English scout cruisers, the *Theseus, Gibraltar* and *Hawke,* which she is reported to have located far away from its base and in the neighbourhood of the Scottish coast. In this case, the submarine succeeded in sinking the *Hawke,* an armoured vessel of 7,350 tons, and while her sister-ships escaped, they failed to capture or even damage the little German raider.

The *Pathfinder,* a fast scout cruiser of about 3,000 tons, was also torpedoed. The super-dreadnaught, the *Audacious,* of 23,000 tons, lay on the bottom of the Atlantic Ocean for more than two weeks before the British Admiralty announced the loss as an accident caused by a drifting mine. Before this book can appear, perhaps the mystery of this "accident" will be unravelled.

By hook or crook, the British Government has tried to make it appear that the losses inflicted upon its fleet by submarines are inconsiderable, but the fact remains that German submarines, handled by expert crews and officers, are doing the lion's share of the fighting against overpowering odds not only in war vessels but also in the submarine flotillas of the Franco-British fleets. No amount of censorial "doctoring" and official paraphrasing will lessen the weight of the fifty-thousand tons' argument in sunken British cruisers on the bottom of the sea; and no further attempts to explain away the successes of German submarines as accidental will avail to blind even the laity to the fact that the submarine has ceased to be a mere harbour defence auxiliary and has become

a most formidable weapon of attack, comparable to that of the capital ship.

Ignoring "Tin Sardine"

A decade ago, the submarine was practically ignored by naval men. Its limited range, slow rate of speed, and poor sea-going qualities made the "tin sardine" an object of ridicule in mess-rooms. It was relegated to the rear as being of probable moral, but not much practical, use in assisting the defence of harbours and land fortifications. But the "tin sardine" is grown up now. Germany has at least a dozen fine, husky specimens, averaging over 800 tons with a tactical speed of 10 knots when submerged, a strategical speed on the surface of no less than 17 knots, and a cruising radius of upward of 3,300 miles. If the crew could hold out it should be possible to send a shoal of such "tin sardines" across the Atlantic, but whereas a decade ago man was stronger than the machine in a submarine the opposite is now a fact: the machine commands the man. Not only can the modern type of submarine hide on the bottom of the sea down to 200 feet when-

ever necessary, and successfully withstand the enormous pressure at this depth for twenty-four hours, but it can avail itself of the air in its oxylithe chambers for breathing purposes and continue to stay below for several days and nights. It is no longer a question of how far the submarine can go on a cruise, but how long the crew can stick it out. The capacity of the petrol tank is far greater than the lung capacity of the crew. In surface cruising, when the vessel can speed along without being compelled to dive for protection against gun-fire, trips of upward of fifteen hundred miles have been accomplished by a number of German submarines seen off the Scottish and Norwegian coasts in this war. This is hard service, however, as the watch on deck is drenched to the skin even in tolerably fair weather, and there are no means of drying clothes. On the other hand, the accommodations of the modern submarine in regard to cooking, washing, garbage, etc., show great practical improvement.

The last decade has been a struggle for speed, principally. While the British "A," "B" and "C" types of craft, laid down in 1901-04, had a surface radius of 500 to 1,800 miles, and a

submerged endurance of 3 to 4.05 hours at full speed, the "D"s and "E"s constructed in 1910-13 have 3,000 to 4,000 miles' surface radius and 5 to 7 hours' full speed submerged endurance. The latest "E"s have three periscopes for scouting the entire arc of the surface, and are so powerful that they can cruise from Yarmouth to Gibraltar, fight an action there and return to Yarmouth without drawing on any vessel or base on the way. These boats carry no less than six long-distance Whitehead torpedoes, weighing 1,300 pounds each, with an initial speed of a-mile-a-minute and an explosive charge of 200 pounds of wet gun-cotton. It is quite strange that the British have not been able to deliver a single blow with "E" boats, at this writing, for not only in range and power and number of torpedoes are they superior to the German "U" class, but, technically at least, the English boats are speedier and more formidable. The conning tower of the latter is protected by a 4-inch armour plate as a protection against the rapid artillery of destroyers, and disappearing 12-pounder quick-firers are carried for attacking seaplanes.

Of course, the submarine is preëminently the

weapon of the weaker naval power. With the continued naval pressure of the combined French-British fleets operating against her North Sea coast in overwhelming force, Germany had no other alternative but the defensive. To her credit it must be observed, however, that she has managed to turn her defensive into bold offensive coups at times by means of submarine attacks. She has used this alternative chiefly because it is the only one available with any degree of success in fighting a heavy blockade. As the only practical protection for scout ships against submarines is frequent change of course under good speed, backed by eternal vigilance, it was natural and logical that Germany should seek to harass the movements of scouts by setting out mines as she did. Having thus availed herself of the menacing danger of the anchored and the floating type of submarine mine, Germany lost no time in hurling her submarine boats against the blockading fleet. By these tactics she placed the enemy in the not enviable position of being compelled to move on for fear of getting speared by the torpedo of the submarine, and at the same time being required to go slow for fear of colliding

with a contact mine! No one not personally acquainted with naval routine can appreciate the strain on the vigilance and resource of fleet crews when perplexing conditions such as these are imposed with never-flagging severity week after week, month after month. It speaks volumes for the discipline of the British Navy that its losses were not larger during this period, when the demoralising factors must have been appalling.

The naval strategy plotted by the German Admiralty has worked out remarkably well. To attack by submarine chiefly and prevent the enemy from using his submarines in reprisal—this seems to have been the plan, at least, the preliminary phase. Hence, the German fleet was ordered to its naval bases on the North Sea there to remain under the additional protection of the coastal forts. Screens of heavy steel-wire mesh were anchored across the egress to every base, and immediately behind the scouting line mine fields of the contact type were planted. Mine-laying craft were deployed to load the waters beyond the scouting lines with floating mines. In other words, a British submarine advancing to attack the German fleet

would encounter—first a danger zone of drifting mines, any one of which would send her to kingdom-come by contact, and secondly she would face gun-fire by destroyers and scout cruisers. Granting that she might, perchance, discover an opening and slip through the scout lines, she would certainly run into the anchored mine field or the steel-wire screen studded with mines, which shield the German ships of the line in the roadsteads against sanguinary exploits of this kind. When a fleet has thus protected itself against submarine as well as torpedo-boat attack it is next to impossible for a blockading fleet, no matter how superior, to force it into action, to dig it out. Against the chief advantage of the blockader, which is keeping the hostile fleet bottled up, the defender has the not undesirable privilege of choosing his time and place for action. The German admiral can order a submarine attack on certain British vessels, and he has done so—but the British admiral cannot order a similar attack, and he has not done so. The North Sea has been open to German submarines because there was always a chance of their finding a quarry some time. The English submarines have had nothing to

hunt except mines, which they are supposed to dodge, and destroyers, which are usually too speedy to lend themselves as likely targets.

Even under favourable circumstances it is by no means an easy matter to drive a torpedo into the bowels of a moving war vessel. A ruse is sometimes needed. It appears that Lieutenant Weddigen, in attacking the *Aboukir*, laid a trap for that ship by getting behind some fishing smacks that were apparently laying mines. As the *Aboukir* bore down on the smacks, followed by her two sisters, the "U 9" dove and launched a 21-inch calibre torpedo into her, repeating the manœuvre until all three ships were on their beam-ends and sinking.

How It Works

So long as newspapers persist in describing Zeppelins and submarines alike as "cigar-shaped," I am really at a loss to know how a real submarine looms in the mind of the layman. At the outmost it could resemble only a very bad cigar. The main changes in the outward contours are a tendency toward longer lines and increased sea-going features. More than ever

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The latest type of British submarine, Class "D," with armored superstructure and deck guns for repelling destroyers.

before is care observed in the riveting of the various seams, and the latest boats show notable improvements in speed, size and cruising qualities.

The manner in which a submarine is operated is very interesting, but the work of describing the operation in plain language is a cruel test of human patience. Briefly, then, the submarine has a sort of dual existence. When the boat is awash and under cruising speed it is operated by its gasoline engine quite like a motor boat. While thus cruising about the boat is under what is called its "strategical" speed because it is moving from its base to a place selected for an attack. When the boat arrives at this place and dives, it is operated during the period of submergence by electric motors, and the steering, pumping, handling and loading and firing torpedoes is done pneumatically and electrically. A motor boat on the surface, an electric diving-boat under the surface—I wonder if this explains anything? While running submerged the boat is considered as being under its "tactical" speed because, having arrived at the point determined by its strategic voyage, it moves on its target and completes the assault.

The gasoline as well as the electrical engines are marvels of compactness and efficiency. The gas engine may drive propellers directly—and it always does when the boat is awash and cruising—or it may be disconnected and drive a motor as a dynamo, which in turn generates electricity for charging the storage battery. With batteries thus charged the boat can dive and the electric motor, drawing upon the power thus stored up in the batteries, will drive the propellers and do all necessary work while the boat is running submerged.

The gas engine may also be used for driving an air compressor, and the power thus stored is made available for bailing out the ballast tanks, for driving the bilge pumps, or for ejecting torpedoes while submerged. On the tail shafts running to the propellers are several clutches for effecting these changes.

When the ballast tanks are empty a submarine boat usually weighs about twenty per cent. less than an equal volume of water. The boat may be made to float high or low by adjusting the amount of water in the ballast tanks. This is called "trimming." There are so-called "trimming tanks" both in the bow and in the

stern. Unless the boat is properly trimmed it is likely to turn turtle when advancing under speed. Sometimes it is expedient that the boat should be brought to a full stop when submerged and float motionless at any predetermined depth. An "adjustment" tank is available for this manœuvre.

The steering below the surface is done by horizontal and vertical rudders. The surface navigation is by compass, chart and sextant. The latest boats have two periscopes, one for the helmsman looking straight ahead, and one for the commander, giving a zonal view all around with binocular enlargement when desired.

The angle of diving and rising is automatically controlled. A so-called "crusher" gauge prevents the submergence of the vessel to depths where the pressure of the water would endanger its structural safety. A "depth" gauge shows distance below surface while submerged. Other gauges and dials indicate the vessel's speed, the amount of fuel oil carried, the stored electricity on hand for submergence runs, the reserve compressed air for breathing and for launching torpedoes, the temperature, water on hand in bal-

last tanks, etc. Everything is "dialled," everything is gauged. Turn a handwheel, pull a switch, throw a lever: these are the operating motions. There are none other.

In a boat carrying three torpedo tubes a crew of only five men working in unison can operate the craft during submergence. First man is at a handwheel controlling horizontal or diving rudder. His eyes are glued to a gauge showing degree of submersion and an inclinometre for maintaining an even keel. Second man operates the vertical helm from the conning tower, steering by compass. Third man is an engineer in control of the electric motors in the stern of boat. Fourth man stands by the central handwheel at the torpedo breeches in the bow of the boat. Fifth man is the commander in the conning tower. He signals the men with speaking tubes. The fourth man's job is to spin the central handwheel till the bow-cap at the end of the revolving axis is slid forward a bit, when it is revolved until the two holes in the bow-cap disclose a torpedo behind each. When closed the bow-cap is in reality the bow of the boat, but the cap is necessary to prevent the egress of water into the torpedo tubes. Each torpedo

has a breech with a handwheel. The fourth man fires them on signal by spinning the handwheel, which releases the pressure in the pneumatic compressor, and out flies the torpedo at a mile-a-minute clip.

Most boats can dive within the three-minute limit. Only a man with quartermaster's experience should be intrusted with the horizontal rudders, as too much helm when the vessel is plunging may capsise it. Running at 10 knots submerged, the maximum speed, only 5 degrees of horizontal helm is required to complete a plunge to the 20-foot war level at an inclination of 3½ degrees.

There is no vibration in a boat running submerged. And there is no noise except for the hum of the motors relieved by the speaking-tube commands. The ventilation is not much worse than that of the New York subway, but better care is exercised in renewing it. Steel flasks with compressed air or oxylithe supply new air while the carbonic acid gas of the respired air is chemically absorbed. Food is cooked for the crew on a handy little electric stove. Drinking water is on tap in large steel flasks. There are pneumatic pressure exhausts for garbage,

refuse, etc. Meals are served on trestle tables amidships. Hammocks are slung under the deck for the crew and only the officer has a berth—collapsible. And, to complete the technical roster, no white mice are carried any longer to detect gasoline leaks aboardship!

Attack and Defence

Submarine does not fight submarine for obvious reasons, and as the only effective weapon against it is the naval gun, the methods of protection devised naturally assume the character of a tactical defensive. The attack is always launched by the submarine. There is no single instance in this war of a naval vessel having ferreted out a submarine, giving chase and sinking it. Destroyers and light scouts have happened upon submarine craft in thick weather, but such encounters have been mostly accidental and not the result of a plotted chase. The tactical defensive of naval vessels, then, consists in a combination of preventive measures. The best protection for vessels on blockade patrol seems to be a good rate of cruising speed with frequent alteration of the course.

Vessels thus deployed under steam should always be convoyed on either board by flotillas of destroyers. The great mobility of the mosquito craft enables them to attack quickly under full speed and focus their rapid artillery on any rising submarine and also, if the distance is not too great, to ram the same. A fleet at anchor, however, must rely on carefully set mine fields, steel-net obstacles, and, in the last instance, on liberal subdivision of the hulls in watertight compartments. Some of the latest dreadnaughts are furnished with extra internal armour as a protection to its vital parts against torpedo attack, especially the projectile magazines. The belief has been expressed by some naval writers that thorough subdivision of the hull would have saved the three ships of the *Aboukir* class from foundering, but the fate of the *Audacious,* which was minutely divided by more than five hundred compartments below the armour belt, does not provide a good argument for the subdivision plan, irrespective as to whether a mine or a torpedo sent her to the bottom. Personally, I am inclined to think that a combination of destroyer with seaplane scouting will be found to be extraordinarily effective

before the signal "cease firing" flaunts over the North Sea. For detecting submarines there is no agent that can compare in efficiency with the seaplane, and the destroyer is the best weapon of attack against them. The records of naval aviators show that submarines running submerged can be spotted by air scouts from altitudes ranging upward to 1,800 feet, that is, when the atmosphere is calm and clear. In rough weather the scouting must be done close-in to a couple of hundred feet over the surface, but even under this handicap the scouting of the seaplane will be more exact and thorough than that of any other known agent, and the destroyer is more readily available to take prompt advantage of the successful spotting by the seaplane.

Operations in the North Sea have shown that the chances of a destroyer getting close enough to drive home its ram in a submarine are better than naval critics expected. In fact, owing to its thin skin of soft iron the submarine is the most vulnerable of all naval craft; the slightest touch of a speeding destroyer is quite certain to open a seam or rip a hole in the hull. The multi-periscope craft ought also to provide a fairly good target for the rapid artillery of

the destroyers even when running submerged with the eye-pieces awash. Two or three periscopes cutting across the surface over a single submarine could easily be put under zonal fire by the destroyers when a loss of one or all of the periscopes would be a practical certainty. Bereft of its tactical "eye" the submarine would not be able to manœuvre for an attack.

The Automobile Torpedo

Hand in hand with the development of the submarine boat has gone the improvement of the automobile torpedo—its only weapon of attack. It is not generally realised that the kind of torpedo used in the Russo-Japanese engagements of 1904 is little more than a toy compared to the torpedo of 1914. What was gun range then for battleships is torpedo range now. A decade of constructive experimenting has evolved a marine weapon that will rip through six miles of water at a 40-knot pace and knock down a super-dreadnaught! To be sure this is the extreme performance, but it has been done dozens of times in practice tests and it will doubtless be done in actual battle if this

war demands it. At any rate, the "safety" battle distance of modern naval tactics has been raised to five miles, and it is the automobile torpedo that has raised it rather than the naval gun. Five miles' battle distance means that vessels engaging in combat are warned not to venture inside the five-mile zone, as by so doing they expose themselves to the long-distance torpedoes carried by cruisers and battleships. This in turn means that the naval artillery must do its main effective work before the vessels approach the five-mile limit. Between the ten-mile and the five-mile ranges the naval gun has the decision. As long-distance torpedoes are not generally carried by submarines, the latter will probably not be employed in a running battle action between ships of the line except under extraordinary conditions.

The much-abused term "cigar-shaped" may be applied with perfect propriety to the contours of the automobile torpedo. The internal mechanism, which was kept a close secret for so many years, presents one of the most ingenious methods of adapting a self-regulating steering gear to a self-propelled, high-speed submarine weapon as yet invented by the mind

of man. Plainly speaking, then, the bow section of the torpedo—usually called the war-head—is charged with upward of 250 pounds of gun-cotton and fulminate of mercury. Through the longitudinal centre of this charge runs a tube loaded with the detonating explosive. This tube has a plunger point at the extreme front end, which protrudes beyond the war-head and strikes the target first. The plunger acting on the detonating charge in the tube explodes the war-head. The section following is a steel chamber loaded with compressed air, which is used as motive power for the machinery in the adjacent "secret" chamber. This machinery not only drives the propellers by means of a turbine engine, but regulates the horizontal and vertical rudders with quite an amazing degree of automatic precision. The controlling mechanism in the secret chamber is so exact that as soon as the torpedo is launched the horizontal rudders operate so as to maintain the missile at the prescribed depth of 15 feet below water, while the vertical rudder keeps it pointed toward the target. Simultaneously a small hydrostatic chamber opens and absorbs enough water through its perfora-

tions to maintain a steady course and even keel for the flying missile. The twin propellers are mounted on the same axis and are made to counter-rotate in order to prevent swerving from the course.

By Gyroscope and Superheat

The most interesting and valuable improvements in torpedo construction, however, centre around the introduction of the gyroscopic gear and the ignition superheating of the compressed air. The gyroscope was adapted to torpedo requirements because it was found that occasionally a torpedo would balk and act "mysteriously" for no ascertainable reason; in some cases it would suddenly fly from its course in a wide circle and dart back at the vessel firing it. The latest type of gyroscope gear is electrically driven and is connected up with the rudders to such an accurate degree of mechanical nicety that it is feasible now to launch a torpedo from the starboard tube against an enemy approaching on the port bow, or, as a newspaper man would say, to "shoot around corners." A gyroscopically controlled torpedo

when fired broadside from starboard can be made to sweep through an angle of 45 degrees around the prow of the launching vessel, continue the arc for an equal number of degrees on the port side of the prow, and speed straight ahead for a target several miles distant. To recapitulate, a cruiser with a main battery of 6-inch rifles could venture to attack one having 8-inch rifles by speeding in beyond the five-mile limit and launching its torpedoes under gun-fire. While firing salvos of 6-inch projectiles over the port side, the cruiser fitted with gyroscope torpedoes could launch these over the starboard side, and a single hit of such a missile would be more disastrous, in most cases, to the heavier cruiser than the effect of its heavier gun-fire on the light cruiser.

The superheating of the compressed air causes it to expand and increase in propulsive capacity. Before this discovery was made and applied, the temperature of the compressed air, owing to gradual escape in feeding the motor, would frequently fall below zero, when the remaining air charge would fail to expel itself with force sufficient to be effective. The low temperature would cause the lubricants and the

exhaust to clog, and put an insuperable limit to the effective range of the weapon. Of the two hundred pounds of compressed air stored in the chamber, little more than 150 pounds could be made available for use; the rest was dead weight. There are several methods of superheating, but the ignition plan appears to be the simplest and most effective. It consists of a mechanism which ignites an alcohol flame in the air chamber at a point when something like half the distance has been negotiated by the torpedo. The air remaining expands. The high speed attained up to this point is thus maintained to the end. The range is considerably increased. It is largely through the successful application of superheating that torpedo speeds have been increased from 30 to 50 per cent. during the last few years. Whereas formerly the extreme speed attainable at 1,000 yards was 35 knots with a 21-inch torpedo, the same weapon will travel at a rate of 44 knots with ignition superheater.

The Submarine Mine

The submarine mine caused great damage in the Russo-Japanese engagements, and is keep-

ing up its record of destructiveness in the present war. It is difficult to say which of the two kinds—the anchored or the floating mine—is the more dangerous, but the trouble seems to be that they are not dangerous to the enemy only. The loss of the *Speedy* and the *Amphion* to the British, and the loss of the *Yorck* to the Germans, are significant instances of the almost prohibitive danger involved in the planting and maintaining of mine areas.

The floating mine is provided with a trigger-handle. As soon as this handle jostles against the hull of a ship the detonating charge acts on the explosive loaded in the mine and the blast follows. To make this operation more certain, mines are frequently anchored in pairs, that is, two mines are connected by a light steel cable, supported by floats, each mine being anchored besides, of course. As the ship touches the cable and advances with it on its prow, the mines attached to the extremities of the cable are forced against the vessel, one on either side, and a double explosion is the result. The usual depth at which the anchor mine is planted is fifteen feet below the surface. Heavily mined areas have series of anchor mines for depths

scaling down to twenty-five and even thirty feet, one tier of mines above the other.

The naval operation known as mine sweeping is not a popular one aboard the mosquito flotilla. Two destroyers advance to the field dragging a length of light chain cable between them. They keep well abreast of each other and are separated by one or two cable lengths. The bight of the cable is dragged across the bottom of the sea and the mines thus caught in the cable soon jostle together and explode—but not always without damage to the destroyers. Of course, mine sweeping of this sort would be impossible under shore batteries or close to a hostile squadron, but it is the only efficacious means known for clearing the high seas of the deadly menace of drifting mines.

The fouling of a German submarine in a fish-net off the Dutch coast may suggest the use of special nets as a defensive measure against submarine boats as well as submarine mines in this war. The heavy nets used for deep-sea fishing, if properly weighted and boomed out, should be able to tangle almost any submarine, and it should be possible to take advantage of the current and dispatch net sections on booms to foul

the mines in the mouths of harbours and thus cause them to explode. A rope around the propeller of a submarine is apparently sufficient to put the little assassin of the briny depths out of action.

Seaplane Torpedoes

The fact that seaplanes have been successfully launched from improvised platforms over the decks of war vessels has induced Admiral Fiske of the United States Navy to point out a rather interesting method of launching naval torpedoes from seaplanes instead of from submarines. He contends that while the submarine is powerless to operate at night, the seaplane is ideally fitted to transport a torpedo under cover of darkness and launch it within one-fifth of its striking range against hostile vessels. It is quite true that a seaplane can manœuvre practically invisible at night at an altitude of little less than a mile, but where is the seaplane that can carry two men and the 1,300-pound naval torpedo to a height of nearly a mile? Even if a machine could be perfected to accomplish such a feat the method of manœuvring would be

slow and laborious, which might entail detection, and it would be compelled to volplane to within something less than ten yards to the surface of the water, before it could launch the torpedo, and again there would be the danger of detection, at least by the searchlights of auxiliaries. The idea is fundamentally sound, but a light-weight torpedo of medium range and a heavy-weight seaplane, both specially made for the combined service, are necessary requirements before this ingenious plan could be realised in battle action. It is obvious that a dirigible of the Zeppelin type would have no difficulty in carrying several standard naval torpedoes, but its commander could not afford to risk his ship to gun-fire by approaching the surface to launch a torpedo. The plan is suited only to specially constructed seaplanes. Their vast range of vision, far greater speed, their superior habitability and manœuvring capacity, are the very features which entitle them to tactical preference over submarines for bringing up torpedoes to the point of attack. Submarines for day action and the seaplane-torpedo for night action may be a future phase of war—*deux faces d'un même problème!*

Is There a Super-submarine?

Is there such a thing as a super-submarine? There is. However, only a few of these craft are in active commission, and what is expected to be the ultimate super-ship of the depths is only in the "blue print" stage at this writing.

Of course, one may be permitted to regard the very latest German "U" boats as being in the super class. They displace no less than 850 tons. They are armour-plated over every square inch of visible surface when cruising awash. The turret is of 4-inch Krupp plate and armed with a brace of rapid 3-inch rifles. No less than 5,000 horsepower is stowed away in the Diesel oil-engines that propel this type of craft at a pace of 17 knots awash and 11 knots submerged. In other words, these boats do not have to duck for protection against destroyers. They are sufficiently well armoured to withstand destroyer gun-fire at 2,000 yards and present a much smaller target than the latter. With their heavy shooting 3-inch rifles they are able to open up any destroyer within 3,500 yards' distance, or about two miles. These boats carry

no less than eight 21-inch torpedoes capable of long-range work, and are designed especially for attacking battleships.

The French navy is producing two boats of the same type approximately, though not quite so formidable in armour and armament, but to make up for this they have anti-aërial guns on the turrets, and are supposed to be a trifle speedier than the German craft, at least on paper.

Out of the "D" class the British navy has tried to evolve a super-craft somewhat on the lines of the German and French boats, but there is no official information available as to what has actually been accomplished. England is jealously guarding her progress in this arm. The opinion of naval men is that she will be able to put boats in the water of the super-type before the battle standard is hauled down.

It may be a matter of surprise for most Americans to know that the first submarines for the British navy were built in 1901, from designs furnished by John P. Holland, the American inventor. Italy was quick to follow, France and Russia subsequently adopted the idea. Not

until 1904 did Germany actively begin to produce a flotilla of submarines.

In the meanwhile, the United States navy has been outdistanced by its European rivals, though it remains the pioneer in adopting the first practical boat. A parallel to this curious condition was the pioneer work of the Wright brothers in evolving the first practical aëroplane, and the failure of America to keep abreast with Europe in the further evolution of aircraft.

However, the period of "submarine" apathy has come to an end. The present war has prodded Uncle Sam to activity once more, and the old pioneer has voted himself a lordly check to show the world what he can do in the line of the super-submarine!

Congress has sealed its approval with a grant of $1,300,000, and when the war is over, and all the fighting of a whole generation is done, we shall be able to contemplate this marvellous engine of destruction with the feeling that it "could have licked them all," to anticipate the gentleman of the goatee and the bettle-brow.

There is no suggestion of "tin sardine"

about the new Yankee craft. The foc'sle wits may possibly christen it the "electric whale"! At any rate, it will be larger than any cetacea ever created by Nature or heralded by skipper's tales! It will displace 1,000 tons on a total water-line length of 265 feet, or almost double the capacity of the average submarine boat. The strategic or cruising speed will approach 20 knots and effort will be made to insure a tactical or submerged speed of 12 knots. It will be a sea-going submarine in the completest sense of the term, inasmuch as it will have a cruising radius of 6,300 miles and a submerged radius of 3,200 miles. She can trail a modern fleet of dreadnaughts and cruisers, which seldom averages more than 14 knots in times of peace and 18 knots on a war footing, and go where they go without being outdistanced, except when the wireless signals forced draught and cleared decks. She is armoured over all her visible hull heavily enough to stand an engagement with light scouts and destroyers, and her armament of three 4-inch rifles should enable her to rout such craft, as she herself presents but a poor target. Her torpedo equipment is tremendous. There are ten tubes, each capable of launching

a 21-inch long-distance torpedo with a war-head of 390 pounds of gun-cotton, over a range of 3½ miles. An ingenious departure in the torpedo armament is effected by placing the six tubes in the hull as fixtures and putting the four remaining tubes on pivotal disappearing carriages on the deck. By virtue of this equipment the new super-submarine can sweep the horizon at any angle with four torpedo tubes while awash and cruising, which in turn means that any cruiser venturing within gun-range is within reach of the four torpedoes on her deck that are easily concentrated on a target. If the enemy is too formidable the boat can house its deck torpedoes in the twinkle of an eye, and dive to its submerged level where it will have the use of four tubes in the bow and two tubes in the stern.

If the new submarine monster proves a success—and there are no technical obstacles—the time will be approaching, as prophesied by Admiral Sir Percy Scott, when submarines working in conjunction with seaplanes will decide naval battles, and not the super-dreadnaught. At any rate, no battleship as yet devised could attack a super-submarine of the type proposed

and escape its torpedoes unless it were to be most efficiently protected by a veritable cordon of destroyers and scouts, but even the British navy cannot guarantee protection on this scale at all times.

CHAPTER IV

THE CAPITAL SHIP

Super-dreadnaught vs. Battle Cruiser

The North Sea is seldom calm where it rolls into the Skagerak, that stormy strait, whence Norse sea kings were wont to sally forth under bellying sail with crews of vikings in mail and plate, bending to the ponderous oars. No sail in sight, only a fane of inky smoke on the horizon. By-and-by two funnels can be seen under the threatening curtain and a low rakish vessel heaves into sight, cutting the water with incredible speed. It glides through the heavy sea, tapering smartly from bow to stern, as though its long, sleek sides were not armoured as stoutly as a fortress. The deck is dotted with steel turrets spiked with monster cannon, each turret a citadel itself. The whole vessel is contrived like a floating fortification, but it moves and steers with nimble ease as though it were the merest cockle-shell and the giant guns but tubes of paper. This, then, is the modern sea-king, the battle cruiser of the high seas, an armoured, turbined, heavily-gunned brother-

in-arms to that adventuresome craft of yielding hemp and canvas, the viking bark of old.

Suddenly the course is changed. Bugles call, buzzers snarl, dials oscillate, levers click, handwheels spin, and at every battle post electric signals register the commands from the bridge. The decks are cleared for action. The monster turrets swing into position over the port side. The menacing muzzles of a dozen huge cannon rise as by magic to an acute angle, remaining in focus there.

Another fane of smoke has broken on the port bow; another vessel less tapered but more ponderous has appeared under three stout funnels. A thick wave of foam curls under the massive prow. The decks are dotted with turrets even more ponderous, spiked with giant guns even more overawing.

Not a man is in sight on deck even though there are almost a thousand souls aboard either one of the marine monsters intent on mutual destruction.

At ten miles' range the super-dreadnaught opens fire with a shot from one of its mighty 14-inch rifles. The sound of the ton-heavy projectile as it hurtles screaming through the air is like a death-gasp from the underworld. The missile remains in the air something like a half-minute, but it seems hours before it strikes,

tossing a crater of water as it explodes. Another shot follows and a third as the big sea-fighter improves his aim; but before the accurate range can be learned the battle cruiser has changed her course and bears down upon him under a full head of steam.

Range shots explode on all sides of the battle cruiser as she continues her grim advance at desperate risk, until the distance falls under the effective range of her 11-inch ordnance. Once more the battle cruiser lays down her helm, and as her freeboard swings into play under full speed the whole ship seems to jump out of the water under the shock of a tremendous explosion. A broadside of 11-inch pieces has been fired. The air moans and howls under the onslaught of the storm of projectiles. Half the guns have been aimed short, the other half long, of the plotted range. The long shots take their toll. The super-dreadnaught is discovered without her aft funnel and a jagged hole yawns under her superstructure, emitting smoke and flame and hissing steam.

Something knocks in the port plates of the battle cruiser and explodes on her berth-deck, killing two gun crews, choking the hull with fumes, and wrecking three 6-inch guns—the first bull's-eye of a 14-inch shell. The battle cruiser, being quicker at the range-finding, manages to land two salvos of her big guns before she has

to take the full punishment of her adversary's 14-inch ordnance.

Those two salvos save the battle cruiser. Of the twenty projectiles fired at the super-dreadnaught, thirteen have taken their toll, some of them hitting in the same spot. Her gunners have understood how to concentrate their fire with admirable skill. A water-line hit, breached by the first salvo, was knocked into a yawning chasm by the second, a lucky shot sailing clean through and exploding in the boiler-room, ripping a ghastly hole in the very vitals of the big fighter.

The latter has fired but a single broadside, four shots taking effect, but such is the smashing power of her giant 14-inch rifles that the stern turret of the battle cruiser is breached and the guns wrecked. Other shots have clipped her freeboard and dismasted the foretop.

But that double water-line hit proves fatal to the super-dreadnaught. Before he can launch a second broadside the boilers explode, rolling him over with an ugly starboard list and fouling his aim.

Up to this phase of the action both vessels were steaming freely, the cruiser under forced draught bent on cutting the range to the maximum of her offensive capacity. But the heavy list impairs the manœuvring of the dreadnaught and he is unable to prevent his

fleet adversary from getting within torpedo range. The first missile roams wide, but the second explodes under the dreadnaught's fore-foot, twisting the heavy ram and at the same time detonating his forward torpedoes. The double explosion has the effect of splintering and amputating the entire bow of the big ship.

The havoc aboardship is appalling. On the lower decks are lacerated and bleeding men, seared by flame and smoke, running about in swirling fumes among corpses still warm with the blood oozing from gaping wounds and severed members. The inrush of the sea floods the madly struggling crew before it can force a passage through the wrecked hatchways already littered with dead and dying. A heavy steam-pipe bursts under the deck, scalding many survivors to death with a tremendous roar that drowns their piteous screams. The heavy list puts the big turret guns beyond the power of man to handle; the crews tumble out on the blood-spattered deck. The ammunition hoists jam; the fire-control station dangles helplessly against the mast; the command tubes and signal wires are tangled and twisted out of order; the captain and the officers are powerless to fight the ship any longer. Suddenly there is a wild scramble—panic has seized the crew of the now defenceless wreck—and with one tumultuous yell those who can, leave their posts, and jump

overboard. The officers draw their revolvers, but it is too late for discipline. With one awful blast of escaping steam, punctuated by the dull thud of bursting bulkheads, and the savage crash of plunging wreckage, the super-ship turns up her blood-trickling deck and flame-swept stations and keels over, turning turtle in the heaving sea.

The Strategic Situation

THE naval situation in the present world war provokes comparison with David's dauntless stand against Goliath and Gulliver's pugnacious handling of the fabled giant. As yet there is no indication that the little fellow may whip his ponderous adversary, despite the fact that the former has outstripped the latter as a fighter in almost every action at this writing.

The naval odds against Germany are greater than even the military odds. Not only is Germany compelled to fight the British navy, more than twice as strong in tonnage and armament, but the French navy prevents Austria from aiding her ally and the Russian Baltic squadron hinders the German *grossadmiral* from focusing his entire fleet strength against the British blockade. Add to this the ever-present possibility of Japan dispatching a battle squadron to European waters, not only to convoy an armada of troop ships with military reënforcements, but also to act as a naval reserve for the Allies, and it will be apparent that no matter how

bravely and efficiently the Germans may fight their vessels, they cannot hope to win the naval war. Even if they could manage to defeat a superior unit of British capital ships in a decisive fleet action, the reënforcements available against her by the allied French, Japanese and Russian fleets would enable the defeated British navy to rally and insure a final victory to itself against such units as Germany would have left in this contingency. The German navy may score intermittent victories, ship for ship, and possibly squadron for squadron, and its personnel may demonstrate a superior degree of fighting ability, still when it comes to the great, final line-up and the super-dreadnaughts on either side clear decks for a pitched battle, summoning every class and type of naval craft in auxiliary support of their main offensive, the Germans are hopelessly outclassed.

There are some possible exceptions to be quoted against this estimate of naval exigencies based on the known and certified strength of the opponents. The unknown power of secret armaments must also be considered. It is not logical to reason that because Germany was able to produce secretly made siege artillery that

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"Friedrich der Grosse," a typical example of German super-dreadnaught construction.

ground "impregnable" fortresses to dust, she should also be able to produce naval armaments of like superiority, but it is not unreasonable to assume that the German admiralty has availed itself of the same opportunity for undetected warlike enterprise provided by the German general staff. If the naval Zeppelins now being completed are equipped with apparatus of adequate power to destroy armoured ships rather than for the bombardment of bases and cities, and if by skilful handling of this novel unit the Germans might succeed in sinking a considerable number of the British capital ships on blockade patrol with but little disaster to their Zeppelin fleet, the chances for an equal final combat would be much improved. But unless the new naval Zeppelins can launch armour-piercing torpedoes and detonate heavy charges of explosives in the vitals of capital vessels—unless they can torpedo from *above* almost as effectively as the submarines torpedo from *below*—this new and untried combination of aërial and naval offensive is not likely to be a decisive factor in the naval campaign as a whole, though it might aid in destroying quite a number of valuable vessels.

Another possibility is that Germany may have utilised the respite occasioned by the blockade to install in the turrets of her battleships a larger calibred weapon than the 30.5-centimetre Krupp piece, which is the regular equipment. Efficient as these rifles are, and almost equal in offensive power to the British 12-inch naval gun, they are no match for the 13- and 14-inch rifles, not to mention the 15-inch pieces, which are carried by the latest British superdreadnaughts. I do not mean to suggest that inasmuch as Germany could produce 42-centimetre guns for her army she should also be able to produce 42-centimetre guns for her navy. The technical requirements involved are of an entirely different nature. The military 42-centimetre piece is in reality a transportable mortar in which the gaseous pressure is low compared to the colossal pressure in the breech of a naval gun. The latter belongs in the so-called "direct-fire" category of cannon, which necessitates the flattest possible trajectory, which in turn compels the highest attainable velocity of projectile. In case the Krupps have actually developed a type of 42-centimetre naval gun—and necessarily such manufacture must

have been initiated years ago to be available in proper quantities now—and the capital vessels of the German navy could sally forth armed with 42-centimetre pieces in every turret that held only 30.2-centimetre weapons before, the superiority of the British fleet would be seriously interfered with, to say the least. There may be inherent structural difficulties in the way of laying a 42-centimetre gun in barbettes designed to hold only 30.2-centimetre pieces, but who knows but what this contingency was provided for in advance? Besides, while the power and range of modern cannon have been increased marvellously during the past decade, their space requirements have been noticeably decreased. If only the latest type of German super-dreadnaught could make effective use of a possible 42-centimetre armament, and even if the added weight would make it imperative to limit installation to the centre line turrets, a squadron equipped with such formidable weapons ought to be able to engage two squadrons of British super-dreadnaughts equipped with 13- and even 14-inch primary armament.

I will admit that the deductions entering into this forecast are largely speculative, but I will

not admit that conclusions are futile merely because they have been arrived at by agencies other than those licensed by reason and knowledge. At any rate, the latter qualities made a pitifully poor showing when a wondering world began to draw on them for an explanation of the Krupp secret military armaments. In this connection perhaps it would not be amiss to recollect that the British navy actually boasted 16.5-inch rifles in the early eighties. These ponderous pieces were of Armstrong manufacture and weighed 110 tons each, or fully as much as the heaviest coast defence guns. These giant guns, which were regular primary equipment in battleships of the ill-starred *Victoria* class, required seven minutes to fire one round, weighing 1,800 pounds. While superior in "smashing" power to anything afloat these guns were inferior in penetration to the present 9.2-inch naval rifle. Mainly owing to their tremendous tonnage and slow delivery of projectile the Armstrong monsters were finally discarded. The Krupps became leaders of the modern tendency to make cannon more effective and less ponderous, and it is not impossible that this enterprising, aggressive firm may have evolved a 42-centi-

metre naval rifle only slightly heavier and proportionally less ponderous than the present British 14-inch naval piece. Moreover, the installation of 15-inch rifles in the very latest English super-dreadnaughts goes a long way to show that the improvements made in limiting bulk while increasing power in modern armaments is such that the extraordinary calibres, which were dismissed in the eighties as impracticable, are once more forging to the front, backed by substantial guarantees of superior effectiveness.

Only by perpetrating a combination of superior naval armaments with strong aërial artillery does it appear that Germany could take her several adversaries by surprise and match their superiority with a novel tactical offensive, backed by super-armaments, naval as well as aërial. The Germans have demonstrated their ability to concoct surprise on land; it remains to be seen if they can do it at sea also.

The battle which naval critics have been looking for has not happened at this writing. The battle cruiser has not fought it out with the super-dreadnaught. The experts' attention

is focused on this long-expected encounter, which is supposed to decide whether a few knots of additional mobility and greater steaming radius is an advantage in a running fight, when armaments are practically equal. To sacrifice a little in "smashing" power and range, but nothing in tonnage for the sake of out-manœuvring an adversary that is taking no chances in armour or armament, these are the basic qualities of the battle cruiser which are yet to be tried out in a death grapple with the super-dreadnaught before we know which of these types shall remain the "capital" ship of the future.

The dominant tendency of naval architects appears to favour a high rate of speed backed by a tremendous steaming radius, provided the sacrifice in armour and armament does not disqualify the vessel from combat with the heaviest battle unit—and these main essentials are incorporated with acute insistence in that most modern of modern sea-fighters, the battle cruiser.

The only vessels that have been engaged at this time at all fitted to decide the momentous argument of B. C. *vs.* B. were the *Audacious*

and the *Goeben*. A duel between these two vessels—the latter a fine specimen of the German idea of a battle cruiser, the former a typical example of the British idea in super-dreadnaughts—should have been tremendously instructive if not of decisive moment.

There are naval critics like Admiral Sir Percy Scott who incline toward the belief that the submarine may eventually replace the capital ship. The successful development of the one-thousand-ton super-submarine with huge cruising radius and tremendous torpedo armament, most admittedly points to the day when naval engagements may be fought out under the sea rather than on it, and our gallant fleet admirals may shrink to the proportion of mere submarine savants!

The "Goeben-Breslau" Escape

In a tactical sense the most brilliant exploit of the German navy at this writing was one in which not a solitary shot was fired nor a drop of blood wasted. A powerful British-French fleet chased the battle cruiser *Goeben* and the protected cruiser *Breslau* into Messina harbour,

giving the German commander the choice of suffering the internment of his vessels or facing destruction if he attempted escape. Not only did the German commander prefer the latter alternative, but he managed to hoodwink and elude the overpowering enemy. He handled his vessels so efficiently that he was able to save them from what seemed certain annihilation, and dropped his anchor under the guns of the Dardanelles before the British commander realised that he had been the butt of some clever ruse. The German commander not only succeeded in eliminating loss or even damage, but he added his vessels to the navy of a friendly power, which was destined to make use of them subsequently, and offset a loss suffered by that power in two capital vessels seized by England shortly before their completion.

A naval lesson is pointed by this action. An inferior unit having maximum speed and large cruising radius has not only inherent possibilities for outmanœuvring a vastly superior enemy, but accidental possibilities for outwitting him or confounding his judgment at the executive moment. The speed of a squadron is that of its slowest unit, but the speed of two

fast cruisers is the maximum of their capacity. This will generally account for an advantage of a few knots in favour of the smaller unit. Besides, there are other agencies, such as "jamming" the wireless or tampering with the code of the enemy, which may, in this instance, have aided the escape of the German vessels, entirely aside from their tactical mobility. The court-martialing of the British admiral soon after this episode indicates that contributory causes, more potent than mere mobility, aided in his deception, causes that are likely to remain admiralty secrets.

The Helgoland Action

In the engagement of the bight of Helgoland the British commander appears to have been the abler tactician.

A searching rake of destroyers was deployed as a bait to the German patrol scouts. A light cruiser squadron supported this movement with a powerful squadron of battle cruisers in reserve. The fog enabled the British to screen this manœuvre from the enemy. The Germans nibbled the bait and engaged the destroyers and

the scouts with similar units. Eliminating the destroyer flotilla the main fighting units at this phase of the action included two British scouts, the *Fearless* and *Arethusa,* against three German scouts, the *Köln, Mainz* and *Ariadne.* While numerically superior to the British unit, the Germans suffered the disadvantage of a slightly weaker armament, that is, their total primary power of thirty-four 4.1-inch rifles did not appear to be quite as effective as the two 6-inch and eighteen 4-inch rifles mounted by the enemy. That the *Arethusa* should have been able to inflict most of the damage with its 6-inch pieces, up to this point, is additional proof that the slightly heavier gun possesses marked advantages in an action between unarmoured vessels. As it was, the Germans were not able to inflict much damage before the British battle cruiser squadron hove in sight and took its toll in death shots of 12-inch calibre, placing the German scouts on the loss roster. This engagement contains no lesson of consequence. That it should be possible to bait a blockaded enemy with a rake of scouts, only to insure the destruction of his patrols by driving in a wedge of battle cruisers at the opportune

moment, is a well-enough established tactical contingency.*

The Coronel Battle

The action off Coronel was also decided by superior artillery, although the British virtually commanded the heaviest guns. Admiral von Spee not only outmanœuvred Admiral Craddock, but greatly outpointed him in gunnery. The main fight developed between the armoured cruisers *Scharnhorst* and *Gneisenau,* mounting a total of sixteen 8.2-inch and twelve 5.9-inch rifles in primary batteries, against the *Good Hope* and *Monmouth,* armoured cruisers, totalling two 9.2-inch and thirty 6-inch rifles. The Germans were superior in the weight of metal thrown by sixteen 8.2-inch pieces as against two 9.2-inch pieces of the British, but the latter had the advantage of greater range and "smashing" power in their weapons. As the action was fought in "line ahead" formation the armaments that could be brought to play were limited to two 9.2-inch and seventeen 6-inch

* For an account of the torpedoing of the British cruiser squadron "Hogue," "Aboukir" and "Cressy" see the chapter on "The Submarine."

rifles on the British side against twelve 8.2-inch and twelve 5.9-inch rifles on the German side.

Tactically, the British should have opened fire and made their two superior rifles effective before the Germans could land a broadside. The reports indicate that they either failed to do so or that the shots fell short. At 7,000 yards' range, had the English maintained this distance, they would have been able to penetrate the armour of the German cruisers with their 9.2-inch pieces, while the latter would have been at a loss to hull the British cruisers with the 8.2-inch batteries. Admiral von Spee very cleverly manœuvred his vessels until the range had been cut to about 6,000 yards, when he suddenly opened fire with broadsides of 8.2-inch rifles. It was these well-aimed salvos, concentrated first on the *Good Hope* and then on the *Monmouth,* which sent these fine vessels to the bottom. It is probable that the minimum range during this action did not drop much under 5,000 yards, owing to the sundown, and it is possible that the secondary batteries of 5.9- and 6-inch guns had no decisive voice in the argument. The British 9.2-inch naval gun discharges a

980-pound armour-piercing projectile at the rate of 6.5 rounds per minute with a muzzle velocity of 2,800 foot-seconds and a muzzle energy of 20,685 foot-tons. At 6,500 yards' range a single shot of this calibre could have pierced any part of the German cruisers, not excepting the armoured belt.

The explanation offered by the British admiralty that a heavy rolling sea precluded accurate marksmanship is laughable, for certainly the Germans were wallowing in the same rolling sea and their marksmanship was excellent.

Of scout cruisers Germany had three in this battle—the *Nürnberg, Leipzig* and *Bremen*—opposed to a single British scout, the *Glasgow,* and an armed transport. Despite their vast superiority, in tonnage as well as in armament, the Germans did not succeed in destroying the *Glasgow,* which showed a fine burst of speed, and escaped in a ragged condition. The English cruiser had an advantage of a couple of knots over the German vessels, but the latter matched no less than thirty 4.1-inch rifles against two 6-inch and ten 4-inch rifles of the former. Perhaps the German scouts were slower than their tactical rating, owing to foul

bottoms—a handicap characteristic of hunted fighters—but this does not minimise the tactical efficiency of the *Glasgow's* commander in outmanœuvring his greatly superior opponent.

The "Audacious" and "Bulwark" Disasters *

The loss of the super-dreadnaught *Audacious* in Lough Swilly on the north coast of Ireland shows that a submarine is equal to the sanguinary exploit of cruising hundreds of miles away from its base and destroying the most formidable of fighting vessels. The sinking of the predreadnaught *Bulwark* almost in the very mouth of the Thames proves that a cleverly handled submarine can steal through the most ingeniously planted mine fields and elude hostile scouting screens with a good chance of striking down the enemy on his own base. These two losses, totalling almost fifteen million dollars, constitute a more serious disaster than all the British losses gone before. The naval architects who advocate multiform bulkheads are not likely to refer their arguments to these two

* According to the original British admiralty reports both of these vessels were sunk by contact with mines, but subsequent investigation indicates that they were torpedoed.

vessels, one of which sank like a plummet, the other slowly enough to encourage the belief that it "could" have been saved. The charges carried in the torpedoes of modern submarines are so tremendously effective that the theoretically plausible plan of the "subdivisionist" is not likely to find practical proof in this war. It is all very well to design a ship supporting watertight decks on watertight bulkheads, and it is not difficult to convince naval boards, by a show of mathematical fireworks, that so-and-so many bulkheads may be blown without seriously imperiling the flotation, but wet gun-cotton has a way of opening up a vessel that is anything but mathematically correct. It is fatal to rely on a multiplicity of compartments to prevent a ship from sinking. A torpedo may bend in a score of bulkheads and still the ship may float while another torpedo may blow only a single bulkhead and sink the ship. The pressures developed by submarine explosion are so enormous that not only are the bulkheads blown but the longitudinal seams between the decks are opened, and the leakage thus caused is bound, in most cases, to waterlog and finally wreck the vessel. It is not improbable that some such

erratic starting of seams is what sent the *Audacious* to the bottom.

The Dashing Sea-Hussars

In a tactical sense, the sea-raiding done by the light German scouts the *Emden, Leipzig* and *Karlsruhe* is the smartest exhibition of seamanship in the present war. These three "musketeers" of the high seas have defied capture for several months by a powerful enemy looking for them with wireless and cruiser squadrons in all the oceans. They have been able, not only to destroy scores of hostile merchantmen, but they have provisioned and coaled from their prizes before sinking them, and in some instances they have managed to establish bases on obscure islands. The *Emden,* single-handed, almost swept British shipping off the Indian Ocean and stopped the mail. The dauntless deeds of her brothers-in-arms are too numerous to mention here. Whatever one may choose to think, the fact remains that never before were naval vessels handled with better tactical efficiency and keener resource and daring in the face of desperate odds, than these three daring "Flying Dutchmen" of the seven

seas. The Germans refer to their exploits as "Hussarenstüchsen," and quite so, for cavalry has seldom attempted adventure of a character more sanguinary and romantically warlike. Even the somewhat less brilliant performances of the *Nürnberg* and *Königsberg* would be quite sufficient in themselves to establish for the personnel of the German navy a reputation second to none and equalled by few.

These five German sea-hussars have managed to almost paralyse British shipping in the Pacific, the South Atlantic and the Indian Ocean for several months, and have captured and destroyed more than one hundred hostile merchant vessels. British and French cruisers have raked the oceans in vain, and at one time there was actually a total of some eighty odd vessels commissioned with their destruction. And still they remained afloat, challenging capture with the utmost pertinacity and dauntless daring. The fate of the *Emden* was not accomplished until that little vessel was handicapped by a foul bottom and empty ammunition chambers, and even then it did not surrender, but chose self-destruction.

From a naval viewpoint the exploits of the

German sea-hussars provide a very opportune lesson, indicating that a small raiding unit, efficiently handled, can keep the high seas in good cruising shape for a long time, and do a great amount of damage to shipping under the very nose of a vigilant and far superior enemy equipped with every means for the destruction of the raiders.

Naval Losses Compared

It being the custom of newspaper writers to compare naval losses by the number of vessels vanquished, there is now a widespread delusion that Germany has suffered the severest blow in the loss of 25 vessels as against 20 British vessels, at this writing. Comparisons of this calibre may be instrumental to "headline" artistry, but governments take cognisance of the tonnage and armament involved and the class of vessel. The affixed tables are compiled with a view of determining the relative naval status of the losses incurred on both sides. It will be noticed that the greater numerical German disaster concerns chiefly minor craft of the "mosquito" fleet, while the lower numerical British disaster includes a large proportion of valuable fighting

ships. Stripped of diplomatic phrase, the figures plainly show that the weaker German fleet, bottled up and isolated from its ally, managed to cause the allied enemy a loss of 139,070 tons in the same space of time—approximately fifteen weeks—that she suffered a loss of only 41,559 tons herself! Dealing a blow fully three times as hard as that imposed by its adversary speaks volumes for the superior enterprise and superb training of the German navy.

BRITISH LOSS:

	TONNAGE	PRIMARY ARMAMENT
Super-Dreadnaught		
"Audacious"	23,400	10—13.5 in., 16—4 in.
Pre-Dreadnaught		
"Bulwark"	15,250	4—12 in., 12—6 in.
Armoured Cruiser		
"Warrior"	13,550	6— 9 in., 4—7.5 in.
"Good Hope"	14,300	2— 9 in., 16—6 in.
"Aboukir"	12,200	2— 9 in., 12—6 in.
"Cressy"	12,200	2— 9 in., 12—6 in.
"Hogue"	12,200	2— 9 in., 12—6 in.
"Monmouth"	9,950	14—6 in.
Protected Cruiser		
"Hawke"	7,500	2— 9 in., 10—6 in.
"Hermes"	5,700	11—6 in.
"Amphion"	3,500	10—4 in.
"Pathfinder"	3,000	9—4 in.
"Pegasus"	2,200	8—4 in.
Mine Sweeper		
"Niger"	820	
Gunboat		
"Speedy"	800	
Destroyer		
"Bullfinch"	400	*Total Primary Armament:*
Submarines		10—13.5"; 4—12"; 16—9"
AE-1, E-3, and D-5 ..	2,100	4— 7.5"; 99— 6"; 43—4"
Total tons displacement:	139,070	

GERMAN LOSS:

	TONNAGE	PRIMARY ARMAMENT
Armoured Cruiser		
"Yorck"	9,500	4—8.2 in.; 10—5.9 in.
Protected Cruiser		
"Magdeburg"	4,500	12—4.1 in.
"Köln"	4,280	12—4.1 in.
"Mainz"	4,232	12—4.1 in.
Scout Cruiser		
"Emden"	3,544	10—4.1 in.
"Ariadne"	2,618	10—4.1 in.
"Hela"	2,040	10—4.1 in.
"Cormoran"	1,600	8—4.1 in.
Gunboat		
"Jaguar"	900	
"Iltis"	900	
"Luchs"	900	
"Tiger"	900	
Surveying Ship		
"Planet"	495	*Total Primary Armament:*
"Möwe"	495	4—8.2"; 10—5.9"; 74—4.1"
Destroyers		
S115, S117, and S119	1,600	
S124 and S126	1,050	
S90 and "Taku" ..	825	
V187	680	
Submarine		
U15	500	
Total tons displacement:	41,559	

In explanation of the above estimate, fairness compels me to say that the heaviest German loss was not caused in hostile action, for the *Yorck* was sunk by contact with a German mine. Also, although primary armament is supposed to include no weapon lighter than the 6-inch rifle, I have taken the liberty of extending this classification to the 4-inch rifle, which

is in reality a quick-fire piece. It will be seen that while the British loss in tonnage is more than three times greater than the German, the British armament loss is even much more severe and out of all proportion to that suffered by the German ships. Even were we to include the 3-inch rifles on the gunboats, the proportion in favour of Germany would not be unbalanced. When we consider the complements it appears that something like nine thousand English sailors and officers suffered death or capture against only one-third this number in German crews.

Since the above was written the defeat of Admiral von Spee's squadron off the Falkland Islands by a vastly superior British force increases the German loss in the following proportions: A total tonnage of 32,250 as represented by the *Scharnhorst, Gneisenau, Leipzig, Nürnberg* and *Dresden,* and a total armament of twenty 8.2-inch, twelve 6-inch and thirty-two 4.1-inch rifles. In this, as in other naval engagements, the Germans appear to have fought to the last man and the last gun with an esprit de corps something akin to the berserker fury of the ancient vikings. They refused to

surrender even on honourable terms, preferring to meet death like warriors, singing their national songs defiantly with their faces turned toward the flag until the waves closed over them. The English admiral deserves credit for tactical efficiency in rounding up and destroying the elusive enemy without much damage to his own squadron, which was so vastly superior, both in armour and armament, as to enable him to cripple the Germans at the maximum range before they could return his fire effectively. The fight was so unequal as to be a foregone conclusion: 12-inch ordnance scoring over 8-inch ordnance in perfect conformity with the artillery manuals. The advantage was with the British but the Germans reaped the glory. I do not mean to intimate by this that valour is a historical rather than an active quality in the British navy. The dash of an English submarine below several rows of anchor-mines guarding the Dardanelles, resulting in the sinking of an obsolete Turkish battleship, proves that the British are not content with sporting the laurels of gallant traditions, but quite capable of emulating the Germans in adventuresome exploit.

Technically speaking, the German naval raid

on the Scarborough, Hartlepool, Whitby bases was a most efficiently conducted operation, and apparently without a flaw. The main object—to elude a superior and vigilant enemy and shell his coast effectively before he could gather for pursuit—was accomplished without a hitch. The Germans made their way despite fog and mine fields, and took their vessels inshore where no British pilot has ever taken ships of that size. Their maps were accurate, and in thirty minutes their artillery had found the vital spots in the coastal targets selected. In effecting their escape the Germans appear to have destroyed some of the enemy's torpedo craft, and every phase of their action seems to have been most accurately timed and skilfully carried out. To be sure, the raid accomplished no purpose of material consequence beyond the punishment inflicted on the coast towns under fire, but it demonstrated the fact that England *can* be invaded from the sea, and that the British navy cannot be relied upon absolutely to prevent attack—and the moral effect of this experience is an asset of no mean calibre.

To compare this raid to the cross-ravaging methods of the ancient freebooter, and to cen-

sure Germany for bombarding the English coast while British vessels bombard German bases on the Belgian coast, is little less than ridiculous in a military sense, whatever it may be construed to mean ethically.

British vs. German Naval Status

While it is quite apparent to an unprejudiced eye that the British navy has not been able to prevent its weaker adversary from inflicting vastly more damage than it could deal in turn, it should be said in justice that the British navy on the whole has accomplished the mission intrusted to its care, nevertheless. The British blockade still remains intact. Under its pressure German raids have been confined to the submarine arm, with one exception. The navy made it possible, by adequate convoy lines, to transport the entire available expeditionary army to French soil, a feat that had something to do with staying the German flanking offensive. The navy swept German commerce from the seas and policed the ocean lanes sufficiently to insure the safe passage of troop transports bearing reënforcements from Canada and India,

not a small task, taken in the aggregate, even for a big navy.

Despite the heavy punishment suffered, the British navy is measurably stronger at this writing than at the outbreak of war, owing to the addition of such vessels as were acquired or have been finished in the meantime. As to the immediate future, the status of the German naval programme is such that Germany will gain proportionally more in new additions to her fighting units before February, 1915, than will England. Assuming that the building operations will not fall short of schedule, Germany should have 3 super-dreadnaughts ready in this interim against 2 British ships of the same class. The *König, Markgraf* and *Grosser Kurfürst,* each displacing 26,575 tons, are a more necessary and valuable addition to the German naval needs than the *Warspite* and *Queen Elizabeth,* each of 27,500 tons, are to the already greatly superior English fleet. Germany also has 3 battle cruisers building, all measuring up to the 30,000 tons mark—the *Victoria Luise, Hertha* and *Lützow*—all of them superior to the *Moltke* and *Goeben* class, which would strengthen this arm of her fleet so

that she could venture to match it against England's squadron of 10 battle cruisers. Besides, no vessels of this class are now building in British yards. In armoured cruiser construction there is no activity on either side, but in the *Graudenz* and *Regensburg* Germany has two fine 5,000-ton cruisers of 27½-knot speed that should leave the ways before England could launch any of her newly-planned 30-knotters of the 3,800-ton class.

As far as building activities may influence the naval strategy of the opponents it is evident that while it may be a matter of comparative indifference to England as to the time most favourable for a pitched battle, there is every incentive on Germany's part to assume the offensive as soon as her new battle units are ready for action, as she will then have reached her greatest attainable strength.

In the destroyer and submarine arm there is considerable building activity on both sides. Exactly what the proportional developments are, it is not possible to estimate, but it is highly probable that Germany will try to increase her submarine arm to the very utmost; at least, she has a dominant incentive to increase the arm

whereby she has scored her main successes even to the point of actually commissioning craft of the super-submarine class. England, on the other hand, being tactically on the defensive, is probably striving to strengthen her destroyer flotillas as the most readily available defence against submarine attacks.

The operations of the German right wing along the Ypres channel have puzzled many observers. Why such tremendous military sacrifices should be deemed expedient to occupy an additional strip of coast line, does not appear, at first glance, to be an essential military requirement. Only when the strategical objective of the German admiralty is admitted to consideration does the military necessity for this desperately contended offensive coincide with the naval plan.

It is not possible to adequately mine the strait of Dover. The depth of the current-swept channel at this point precludes the planting of mine fields to effectually repel submarine operations, whereas the distance—some twenty-two miles—is eminently favourable to concerted action by submarine flotillas.

Moreover, should the Germans take Calais

and convert it into an advanced naval base they would be well placed for preventing further reënforcements to the British expeditionary army. Also, should the Germans reassume the offensive against Paris, based on this point, the German right wing, protected by the Channel from molestation, would be in a stronger position than during the drive of the von Kluck army. Besides, such a movement, or even a stand made here, would prevent a concerted operation of the British expeditionary army and the British navy against the German naval bases at Wilhelmshaven, Emden and Cuxhaven. The capture of Antwerp was the first link in this chain of preventive measures against just such a move. The fighting along the Ypres channel was the final anvil blow, and if the chain has been forged by the time this book can appear the importance of Calais as a determining factor will hardly need further explanation. Had the Germans incautiously pushed on to Paris —a movement of more political than strategic importance—they would have exposed themselves to a flanking attack, not only on land but on their blockaded coast, and jeopardised their naval force at a very disadvantageous moment.

Chaos in Naval Nomenclature

Thanks to omniscient newspaper strategists the public mind in this country is now in such a deplorably chaotic state in regard to naval matters that a little elucidation on certain basic, elementary points may find readers.

In these days when boatswains do no "swaining," and ship's carpenters do no carpentering, and seamen are largely incapable of seamanship, naval employments are not what they used to be, that is, the terms remain but the functions have been altered, or, as an American would say, the job has changed. The flag command and the post commission are the chief emblems of the highest naval executive rank. A fleet admiral may have under his command no less than two divisions of eight battleships each, ten armoured cruisers, six protected scouts, and twenty-four destroyers. This fleet is divided into various individual correlative flag commands held by vice or rear admirals. Ordinarily, a full admiral would be assigned six battleships of such a unit while vice or rear admirals would get four, so that each unit of

battleships with its auxiliary cruisers and destroyers would be under flag command by an admiral, and all the units of the entire fleet under the supreme command of the fleet admiral. A squadron is usually a unit or division of a fleet, but sometimes the term is applied to what is in reality a fleet intact, such as the first cruiser squadron of the Channel fleet.

Neither the fleet admiral nor the flag admirals attached to his command have anything to do with the vessel that flies their ensign, which is termed the flagship. An admiral merely uses the latter as a sort of naval headquarters from whence he directs the executive command as regards his particular division. The flagship proper is commanded by a post captain. He is responsible for the ship as the admiral is responsible for the squadron. On a modern seafighter the captain is very little in evidence, however. He does not stand on the bridge with a dapper little spyglass as pictured in the Sunday supplements. The chief navigation officer is the man responsible for the handling of the vessel under way. The chief engineer is supreme in the engine-room. The torpedo and gun crews are under separate commands. The

detail operations of these various commands are discharged by numerous petty officers. In the British navy there are no less than sixty-nine different ratings of such warrant officers, divided into chief and petty grades. The "second-in-command," usually a post commander, is the man on whom devolves the lion's share of what used to be the captain's duties. He is the chief superintending agent of the vessel, and a sort of focus of responsibility. The captain's office nowadays is more like that of chief inspector and final authority in all matters. Of course, when the decks are cleared for action he is in supreme executive command and fights the ship the same as the admiral, using the flagship as his base, fights the squadron under his ensign.

Homogeneity of Units

To some it is a mystery why warships are being built in classes. The Congressional agitation in Washington is limited to idle arguments for or against a two-ship or a three-ship naval building programme, a secondary matter compared with the far greater advantage of es-

tablishing and maintaining a homogeneous fleet. It is of no use to build battleships unless they are at the same time supplemented by the necessary number of cruisers and scouts and destroyers to insure their maximum efficiency in line of battle. A homogeneous fleet is one consisting of squadrons of capital ships built on the class principle supplemented by squadrons of cruisers and auxiliaries built on the same principle. A heterogeneous fleet is one consisting of good "ideas" and political poppycock. To illustrate, a modern homogeneous squadron would include, say four capital vessels of super-dreadnaught calibre capable of 25 knots, complemented by eight armoured cruisers of 28 knots, twelve protected scouts of 30 knots, and a flotilla of 35-knot destroyers. In such a squadron the vessels that must of necessity be possessed of extreme speed in order to do the work assigned to them efficiently—the destroyers and the scouts—are able to move as a unit at their highest maximum speed. One ship is as good and as fast and as well armed as any other ship of that unit. Likewise, the armoured cruisers are able to manœuvre and fight as a unit, and the battleship division can be sent

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The latest model of Krupp 5.9″ quick-fire naval gun as installed on the German super-dreadnaughts.

into action, when the cruisers have prepared the way, with the certainty that no one vessel will outspeed any other and that all the vessels are equal in combative power. Homogeneity in speed, in steaming radius, in offensive and defensive armament, and in class of the units composing a squadron, or in the squadrons composing a fleet, is what makes a naval force effective and efficient. The addition of fighting vessels not belonging in any class or unit of such a force, no matter how powerful, is not an advantage but rather a detriment unless enough such vessels are added to constitute a unit by themselves. If the above outlined fleet were added to by two super-dreadnaughts of 28 knots, the speed of the battle unit would still remain at 25 knots, and as the 3 extra knots were intended to give the 28-knot vessel a chance to select her range and position in an action, this advantage is lost. They would be fought and handled under fire as if they were what they are not, 25-knot vessels, because the action would be based on the class and capacity of the main unit of 25-knot battleships.

If the agricultural gentlemen on whom this country bravely relies to build up its naval de-

fence were to have their way, the United States navy should every year have a brace of monster vessels that would be able to run away from any vessels previously built and so on indefinitely until it would be impossible to gather a squadron of fighting vessels that could be manœuvred together and properly complemented, and this, then, would be a heterogeneous fleet. The French navy is a good example of baneful heterogeneous building plans. It is a collection of good "ideas," not a fleet.

Contrary to the popular idea the lookout in the "crow's nest" is not the man who finds the range and tells the gunners where to shoot. What was once the fighting top of a battleship, bristling with rapid artillery, is now the fire-control station, fitted with apparatus for range finding and observation. An electrical switchboard connects this station with every primary battery.

The heavy guns are inclosed in turrets, protected by barbettes, which are in reality little citadels of armour-plate surmounted by cupolas. The barbettes turn with the guns on cylinders.

Naval vs. Military Strategy

The strategical speed of a vessel is its steaming distance, the factor of mobility that determines its radius of action. The tactical speed is the maximum pace at which the vessel can be manœuvred when going into action. The rated speed is determined by a series of trial trips when the vessel is taken over a measured course under forced draught, aided by supplementary personnel and such added contingencies as cannot be secured under service conditions, hence, the rated speed is always somewhat in advance of practical service performance.

The principles of naval strategy are radically different from military strategy. On land the offensive is the weapon of the stronger, the defensive is the lot of the weaker. At sea the opposite is the case. The more powerful naval force will always attempt preventive measures against the less powerful force, which will always seek to checkmate such measures by intermittent attacks. The British navy is at present on the defensive, trying to prevent the German fleet from breaking through the blockade by

virtue of which Germany's sea power is immobilised. But in order to do more than this—to win an action or a fleet battle—the British fleet must move on the German and risk its vessels against coastal forts supporting hostile vessels. History shows that naval victories are won not on the home base but in hostile waters. Even the German submarine raids were not won near the German coast.

The Under-Munitioned American Navy

The factor of preparedness is a far more important character in naval warfare to-day than ever before in the history of the world. An army taken unawares can be mobilised in a comparatively short time; raw recruits can be drilled for trench duty in ten weeks. But a navy taken unawares cannot be mobilised. Ships cannot be improvised like recruits. There is no such thing as mobilising new units to a naval force. The navy must take such vessels as it has and fight them with such crews as it has. The only kind of mobilisation possible is in bringing the various crews up to their full war complements, but that concerns at best only

a few thousand men. Increased activity in the manufacture of ammunition is also possible, but that benefits chiefly the rapid artillery because heavy ordnance ammunition requires an extremely long time to produce. The only additional vessels a navy can count on in the face of war are such as are building, and may be completed quickly, and such as it may acquire by purchase or capture.

The British and the German navies are models of homogeneous construction and superior preparedness in every department. Of the remaining great navies that of the United States is without a doubt least fitted for actual combat. The vessels are as good as similar vessels of the leading navies, but the tendency to heterogeneous construction cuts down the vessels suitable for duty in first-line-of-battle to a surprisingly small number. And of the vessels suitable for this duty only a few homogeneous battle units can be built. The actual effective naval force which an American fleet admiral could oppose against an enemy would represent something like half of the American naval strength on paper, for not only would it be lacking in the number of vessels fit, but it

would be short of personnel, short of auxiliaries, and, most dangerous of all, it would be short of ammunition.

While it takes five years to develop an expert gun-captain, and four years to complete a super-dreadnaught, it requires no less than four years to manufacture a full complement of heavy naval ordnance ammunition. At this rate it is obviously futile to dispatch "rush" orders to the arsenals once war is declared, and should this happen at the present time, and for some time to come, the under-munitioned American navy could not hope to fight a successful battle with the navy of a first-class power.

The maximum capacity of the United States government arsenals is only 500 14-inch shells in one year—just barely enough to supply one-fifth of the dreadnaught line of battle with its full quota of projectiles. And this was a record performance, requiring a force of more than 2,000 men working double time.

What about the other four-fifths of the big sea-fighters? Aided by the steel works at Bethlehem, Midvale and Watervliet, and such private machine shops as are or could be equipped to make projectiles, it is possible that the govern-

ment arsenals might achieve a complete complement of heavy ammunition for the entire navy somewhat within the four-year limit. We must not forget that in the meanwhile the American fleet would be at the mercy of an attacking fleet inferior in tonnage but complete as to ammunition requirements.

It is not so much a question as to whether a three-ship or a six-ship standard of naval programme is adopted in future. Three superdreadnaughts completely equipped with ammunition and skilled crews, and adequately supported with the auxiliaries necessary to warrant their maximum efficiency in line of battle—such as scouts, cruisers, colliers, repair ships, etc.—would constitute a far more formidable weapon on the high seas than six such vessels with insufficient ammunition, incomplete auxiliaries and green crews. It is the time required, not the cost involved, that the American Congress should consider in planning an adequate navy.

Strategically, the greatest handicap to battle efficiency in the American navy is the lack of an admiralty or a trained general staff of officers. The substitution of a so-called "board of strategy" in the emergency of war is a poor

makeshift. What the general staff is to the army the admiralty is to the navy. An army without the coördinate leadership of a general staff is merely a horde of armed men and quite helpless on the modern battlefield. With no thought of injuring national pride I do not hesitate to say that a single army corps of first-line German troops would be sufficient to deal with the entire American army of regulars. Against a completely equipped and superbly led force of 45,000 troops, the American army could only muster about 55,000 fully equipped regulars, commanded by officers with no divisional or corps training nor versed in tactics on the general scale.

A navy without an admiralty is only a collection of ships. Even if the ships are quite as good as similar ships in other navies they cannot be used against an enemy, to the complete extent of their maximum efficiency, without the preparatory plans and strategic leadership of a general sea staff or admiralty. Not until a coherent plan of organisation is perfected, providing for thoroughgoing military method and coöperation between fleet divisions and an admiralty staff in close accord with the navy

department, may the American navy hope to become something more than a string of ships. Individually, ship for ship, the Americans show up pretty well, and they would approach the standard of the German and British navies were they not under-manned as well as under-munitioned. The suggestions now being made for improving the navy would only raise the individual vessel to the foreign standard, and the navy would still remain third-class as a whole, even if Congress kept on adding vessels until England would be equalled in tonnage. Navies do not enter into duels with single ships, but sail into battle action with fleets composed of many ships. Hence, it is not so much a question of what a certain vessel can do as how many vessels of the same class can be fought as a squadron, and how many such squadrons can be ranged into fleet formation in uniformly equipped and homogeneous battle units. As matters stand now the American navy is not only incapable of defending the country from eventual attack by a smaller but better organised navy, but it constitutes a menace to the national security in that its very presence lulls to sleep the fears of the average American citizen as

certainly as it invites hostile aggression. Sooner or later the so-called Monroe doctrine will compel the United States to fight for it or drop it. It is altogether too sweeping in its contentions to remain unchallenged indefinitely. With Japan in control of Germany's island bases in the Pacific, forming as they do an iron girdle around the Philippines, the blow may come first from the Japanese. Should this happen now the American navy would be compelled to go into action without any general plan of attack, without any plan of battle approach, and without subordinate plans for the torpedo and submarine arms. It would be obliged to improvise these cardinal essentials on which foreign navies, including the Japanese, have spent years of preparation, and its fine vessels and competent personnel would be dispatched into action in a haphazard, discreditable, unmilitary manner, nothing short of criminal negligence. The navy would not be to blame for defeat under these conditions. Only miracles could prevent it.

According to official estimates, prepared since the outbreak of the present war, a fleet of some two hundred colliers and merchantmen would be

necessary to supply fuel and provisions to the American navy when operating five thousand miles from its home bases under war service conditions. Such a fleet of merchantmen is not available. As a substitute the naval auxiliaries might be used, to the serious detriment of the entire campaign, of course. The first-line of battle vessels would have no fast cruiser squadron to fall back on for scouting. There are three such vessels averaging 20 knots, against 28 to 30 knots in foreign navies, and there is not a single 30- to 35-knot destroyer in the American navy that cannot be overhauled by any foreign battle cruiser of 28 knots in rough weather.

Record scores of individual gun crews are desirable, but it is well-nigh fatal to depend upon them and neglect the main requirements of the navy as a whole. In the naval engagement off the coast of Santiago, when a far superior squadron of American battleships attacked four Spanish cruisers, there were forty-one actual hits out of a total of nearly two thousand shells fired by the Americans. There are several crack gun crews in the United States navy that measure up to European standards of efficiency, but

here again we encounter an improvement that only affects certain vessels for a certain time and does not establish the navy as a whole on a standard basis of efficiency. It is the well-worn "star" idea of the variety circus applied to naval needs, and while these are not bettered by it there is an element of "hurrah" patriotism in it, which is very valuable material, indeed, to the bold and fearless gentlemen who are engaged in the pursuit of politics and journalism.

In the opinion of the writer extreme speed, great cruising range, heavy armament and but little armour are destined to be the dominant features in the capital ship of the future. A vessel armed with 15-inch rifles in centre-line turrets, capable of 30-knot speed and endowed with a steaming radius of some 6,000 miles, would not need the protection of armour except in the water-line and in the turrets. Such a vessel would assume the proportions of a super-battle cruiser and could outfight the heaviest super-dreadnaught afloat.

CHAPTER V

THE TURRET FORT

A Bull's-Eye

The Belgian gunners in Fort Pontisse, on the right bank of the Meuse, fought like fiends and endured like heroes. Shell after shell smashed itself into shivers of steel splinters against the armoured dome of the big turret. Shrapnel exploded on the glacis, ploughing ugly scars in the greensward, and on the very parapets they would burst, with a blinding crash, hurling hot slugs and splinters through the embrasures, killing the men behind the guns. But that mattered little. New men jumped to the vacant post, men stripped to the waist swarthy with smoke, men gleaming from sweat and decorated with bloody wounds.

The lieutenant, his blackened head wrapped in white bandages, stood by the gunlayers directing the firing with reeling brain. Half of his men were in the lazaret below, in the concrete bowels of the fort. His captain was killed, his brother officers were maimed, but still he kept on doing his duty heroically.

The ammunition hoist jams and he goes below

to give directions. The crew in the overheated vault is more dead than alive. Some of them have turned raving mad and attack their comrades with sword bayonets; others appear to have lost their hearing. With drawn revolver the officer establishes authority in the pandemonium raging among the blackened, crazed crew in the inferno below.

"To-night we shall have reënforcements and provisions!" he cries, and the men rally with hoarse cheers and a "Vive Belgique!" But "to-night" never comes. As the officer mounts the winding stair to the cupola where the cannon belch forth their crashing salvos, something strikes the big dome with the force of an earthquake and rends it in half. There is a thunderous explosion with a blinding flash of smoke and fumes. As the smoke rolls away there is revealed to view a ghastly crater of jagged armour-plate and broken concrete littered with shattered cannon and torn shreds of bleeding bodies while from below comes a horror-stricken swarm of yelling imbeciles—black, panting, sweating and with bloodshot eyes—struggling through the débris like a horde from hell on doomsday!

The official report states that Fort Pontisse, "after gallantly withstanding the fire of the enemy's field batteries, was finally reduced by a 42-centimetre shell."

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A Belgian battery of howitzers on the firing line in Flanders.

Gruson Forts Not Obsolete

Is the modern type of permanent fortress obsolete? Is the alleged impregnability of steel-turreted Gruson forts a myth? Why, since the heavy German siege artillery was able to reduce the strongest fortifications in Belgium and northern France, are the barrier forts opposite the German line between Verdun and Toul, and Epinal and Belfort, still intact?

Most of the Gruson forts referred to were designed to withstand the onslaught of 4-inch and 6-inch field guns and 7-inch and 9-inch siege artillery. The bombardment of Liège, Antwerp, Maubeuge, La Fère, Laon, and similar permanent works, shows plainly enough that they performed their duty and were able to stand up under the fire of batteries superior, not only in number of guns, but in calibre as well. It was not until the 30.2- and 42-centimetre artillery was emplaced against them that the forts crumbled up and failed to take a strain for which they were never designed. Every German ar-

tillery officer knew that this would happen, but the French officers did not know it until the first shot found its mark. This feat does not prove that Gruson forts are obsolete, contrary to the general opinion; it merely shows that forts, like other products of engineering skill, cannot be expected to perform service out of all proportion to their original capacity. There are Gruson batteries in the German coastal forts, dotting the line between Wilhelmshaven and Brunsbüttel, which are designed to withstand 12-inch and 13-inch naval artillery and capable of returning the compliment with 15- and 17-inch pieces. Had the French and the Belgian forts had the advantage of such ponderous installations, and had the 42-centimetre artillery nevertheless succeeded in reducing them ultimately, it would be logical to conclude that the attack had once more beaten the defence in artillery practice. As the matter stands now, nothing has been settled beyond the fact that 6- and 8-inch Gruson turrets are no match for heavy Krupp siege guns. There is but one possibility of arriving at a conclusive determination of the issue in case those of the vessels in the British channel squadron, which

mount 15-inch rifles, would try these weapons on the armoured domes of the German coastal forts, but there is not much likelihood that such costly ships would be permitted to risk their armoured skin in a sanguinary attack of this order. We have the declaration of a seasoned and fearless critic—the former British sea-lord, Admiral Beresford—that only madness could move a naval commander to oppose coastal works of this type and calibre.

Infantry Protecting Artillery

The forts on the barrier line Verdun-Belfort have not been engaged, not because the Germans have not a sufficient quota of heavy siege artillery, but because the German lines lack the necessary reënforcements to venture out of their present strong intrenchments and force the emplacement of their 30.2- and 42-centimetre guns within range of the forts. On this historic barrier line the world is being treated to the spectacle of infantry protecting forts from artillery attacks, whereas it is usually the forts and the artillery that are supposed to cover the infantry. Obviously it is futile for the Germans

to try to force emplacement when they have not the required force of reserves to hold the advanced position, which would be instantly subjected to a combined attack *en masse* by the French. Not being able to provide emplacement within range of hostile forts, it is, of course, out of the question to employ the 42-centimetre ordnance at all, which again proves the fact, already elaborated in a previous chapter, that it is the infantry which prepares the way for the artillery, the latter being subject to capture or destruction without the support of the former.

The Making of a Turret Fort

The barbette battery, or as it is popularly termed the turret fort, which is named after its inventor, Hermann Gruson, a South-German engineer, is the property of the great gun-making firm, Krupp Aktiengesellschaft. Special machinery had to be invented before it was possible to produce the armour required for the barbettes. Several years of indefatigable experimenting and large expenditure of capital followed before the requisite quality

of chilled cast iron could be produced in the proper quantities. New cranes, moulds, vats, furnaces, machines, tools, etc., had to be contrived and constructed before the systematic production of barbetted fortress batteries could be undertaken.

To the scout who happens to get a glimpse of a Gruson battery undetected, it looks very much like the top of a huge tortoise rising but a few feet above ground. The heavy steel dome is curved to prevent the impact of shell-fire at an acute angle, and it can be rotated around its axis by electric power. The rifles within the barbette are mounted very much like naval guns, and the entire operation of serving and loading the piece reminds of naval gun practice rather than of land artillery. The sighting and loading mechanism of the guns, and the rotating machinery of the barbette, complete the contents of the dome. Below it are concrete vaults, stationary of course, containing the ammunition magazine and hoist, the special engines for supplying power, pumps, tools, etc. The method of pointing such a battery is very interesting. The guns are not turned as in a field battery. The barbette is rotated until the

guns are in line with the target, when the guns are elevated or lowered in the vertical plane according to the range given. Ordinarily this would require quite spacious apertures in the cupola to admit of the upward and downward pointing of the guns, and such apertures would be easy targets for hostile shrapnel fire. Gruson foresaw this exigency and mounted his guns in close-fitting embrasures with the trunnions in movable bearings controlled by hydraulic pressure. Instead of pointing the guns up or down as in other battery systems, Gruson made a departure in gun-laying by fixing the guns in embrasures and moving their breeches up and down. The rotation of the turret involves not only the armoured dome but the combined weight of the guns, the gun-mountings, and the superstructures. In some of the heavy coastal installations the total weight thus manipulated amounts to 2,300 tons, or a greater bulk than has ever been moved before with mathematical precision for any use whatsoever.

Steel Forts of Antwerp Are German

Because the Belgian General Brialmont was instrumental in having Gruson turrets installed in his plan for the defence of Antwerp—and even the plan proper was adapted from the Prussian system—the press has not hesitated to proclaim him as the inventor. The modernisation of the Antwerp fortifications dates from 1909 and includes nine intrenched sections completely encircling the inner belt of forts, built upon the German plan with German guns in German Gruson turrets. The only element in those forts that was not German was the officers and crew, but as none of the forts mounted artillery heavier than the 6-inch calibre it is easy to see that they were no match for the Krupp and Skoda siege pieces.

Firing a Gruson Battery

The Gruson batteries employed in coastal forts are for the most part of the heavy mortar type designed for "high-angle" fire, whereas those in land fortifications use the direct system

of fire control. The gunlayer in a coastal battery cannot see the target he is required to hit. The range is plotted for him by an observer stationed, sometimes a mile away, at a point where he can figure the angle undetected. The lowest elevation of the gun is at 45 degrees and the highest practical range is marked by 65 degrees, giving a zonal arc of fire of 20 degrees. The target is a war vessel and usually it will be manœuvred at a lively pace when within range, which further increases the difficulty of making hits. Fired at the ultimate range of 65 degrees the projectile will remain in the air somewhat more than a minute, during which time a swiftly moving vessel will have covered a distance several times its own length. This, then, is allowed for by estimating the speed of the vessel, but a vessel thus manœuvring against a fort will take care to change its speed as often as desirable to disrupt such estimates. The projectile, when it lands, will not harass the heavily armoured sides of the vessel. Owing to its high-angle path through the air it will either penetrate the light steel decks or smash the cupola of a turret or the poorest protected parts of a warship. But a vessel thus attacked

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A French "Battleship on Wheels," consisting of an armored locomotive, driving platform cars, mounting field guns in rotatable barbettes, and enclosed, armored cars for transporting the crew and stores. On top of the locomotive is a telescopic "fighting mast," for use as an observation and range-finding station.

cannot answer with high-angle fire. There are no mortars aboardship for obvious reasons. Naval vessels are wedded to cannon only, and utilise what is known as the direct-fire system, which has the advantage of much greater velocity and penetration than the mortar shell, but also a much harder task in that the projectile is supposed to hole the armour of ships and steel forts. Mainly because war vessels are practically helpless against the high-angle fire of modern steel forts, which in themselves are very poor targets for a gunner on a floating platform, it has become an axiom among naval commanders not to enter into combat with land forts, at least not forts of the Gruson type.

Bigger than the 42-Centimetre "Brummers"

Germany has about two hundred miles of coast line on the North Sea defended by the most complete system of fortification in existence. Jahde Bay alone is guarded by no less than thirteen detached forts and batteries of the very heaviest class. Some of the Gruson turrets installed there, and at other points, contain the most formidable coast artillery ever

built, the calibres running from 13.9-inch and 14.3-inch to 15.7-inch and 17.7-inch ordnance, more ponderous than even the famous 42-centimetre siege guns. Of course, these giant calibres are installed in the turrets proper while the cupolas mount the lighter 8.2-inch and 9.4-inch pieces. The average main armament is represented by 10.2-inch, 11-inch and 13.9-inch batteries. From the extreme southwestern island of Borkum, guarding the approach to the Ems river, running eastward and northward to the island of Sylt in the North Frisian littoral, the German coast is defended by fortifications of this type. The fact that no attack has been ventured against them by the greatest and most powerful navy in the world, and that their mere presence has discouraged the enemy from enforcing his time-honoured strategy to establish the first line of naval defence on the hostile coast, is certainly a practical argument upholding the defensive efficacy of Gruson barbetted fortifications. Moreover, the presence of the latter has compelled the British navy to content itself with an offshore blockade in greatly extended formation, no squadron venturing more than two hundred miles from its assigned

base on regular patrol duty. This offshore disposition of blockading units has given the German torpedo and submarine flotillas plenty of sea room for assaults on the British lines and bases, an opportunity of which they have availed themselves freely. In the celebrated Spezzia tests when the heaviest cannon produced by England—a 100-ton Armstrong piece —hurled its 2,200-pound projectile against the heaviest Gruson plate produced by Germany without breaching it, though three shots were fired at close range at the same plate, there is not the ghost of a chance that British battleships mounting guns of inferior smashing power, being compelled to fire at long range, could seriously damage the Gruson barbettes of the German coast defence.

Helgoland—The Fort Impregnable

If the pressure of the British blockade could be brought to bear on the Kiel canal, the British, and not the German, navy would be in control of Helgoland Bight. The control would extend in a line running across the bight from the mouth of the river Eider to Wangeroog in the

East Frisian littoral, and a close-in blockade would then be possible, checkmating the slightest attempt at a German offensive. But the island fortress of Helgoland stands in the way spiked to the crags with enough heavy ordnance to fight the entire British fleet, and whatever ships might break through would court certain destruction by the German Hochseeflotte.

In the centre of the island fortress is a mortar battery, mounting 11-inch and 16-inch pieces, capable of smashing through the decks of battleships at from five to eight miles' range. The direct-fire batteries are placed in tiers one over the other to a height of 176 feet above sea-level. The heavy pieces are placed below and range in calibre from 13.9-inch to 17.7-inch; the lighter ordnance is emplaced in the upper tiers and consists of 8.2-inch, 9.4-inch, 10.2-inch and 11-inch rifles. Here is an argument for the defence offered by Gruson barbetted forts that is not even partially answered by the fate of the inland forts in France and Belgium.

Shooting Across the Channel—in Print

Be it said right here that the reiterated newspaper rumours anent the emplacement of 51- and 65-centimetre guns in German coast batteries, ostensibly on a line approaching Calais from Ostend, with a view of bombarding the English coast and knocking the British fleet off its base, are nothing short of balderdash and poppycock. Even though Calais were captured for a base it would be a physical impossibility to aim cannon across the Channel, even if cannon actually existed that could cover the distance of 22 miles. Such scaremongers usually forget something, in this instance that the earth is not flat but round, and that the resultant curvature beyond a radius of eleven miles does not lend itself to calculation by the range-finding apparatus nor to observation. Batteries emplaced on coastal points along the Channel are intended only as a defence against a close-in blockade of the British fleet, but certainly not as a means of attacking the British coast, and for such a defence it is not necessary to conjure forth artillery of fabled capacity when

42-centimetre mortars are more than formidable enough to keep the enemy beyond the offshore radius of sea pressure. At 10,000 yards or about six miles these giant mortars can be depended on to achieve the very remarkable score of 3 hits out of every 4 shots fired, which corresponds to their average hitting percentage of 75 in target practice. Much larger ranges have been covered, and record targets of 90 per cent. have been achieved, but the above represents the average effectively offensive power of such batteries, which is more than sufficient for any emergency.

Rifle Against Turret Fort

Strange as it may appear to the laity, the only available weapon against a Gruson battery is the infantry rifle! If the Germans should be able to oppose the French with much superior numbers of infantry on the present intrenched lines, the attack against the barrier forts—rifle against turret cannon—would probably be conducted as follows: A night raid *en masse* would be made with a view of carrying the French trenches. During this manœuvre the German

infantry would have the support of machine guns and light field batteries besides a number of searchlight stations to expose the enemy to view and blind him at the moment of his counter-offensive. The Germans might have recourse to illuminating bombs, that is, a new type of shell which causes no physical harm, but explodes a zone of luminous balls that descend very slowly, casting a vivid, steady light over a large area. As the gun does not betray its location it is possible by this means to subject the enemy's movements to almost constant observation, for what the beams of the searchlight would not disclose could assuredly be ascertained by the explosion of luminous bombs. We will assume that the Germans have prepared a long time for the attack and have succeeded in pushing the sap-head of their approach trenches to a point within storming distance of the besieged intrenchments. These approaches issue in a zigzag line from the main trenches. They are dug by sappers at night, and the zigzag shape protects such approaches from cross-fire. In order to hoodwink the enemy and make it difficult for him to determine from which direction the main attack will be launched, some

of the approaches dug serve merely as blinds or they may be used in flanking operations.

Although the attack is aimed ultimately at the fortress the initial phase of it concerns only the intrenchments of the infantry, which are sufficiently far advanced to prevent the Germans from emplacing siege artillery and getting the range on the fortress. These intrenchments are protected by a maze of wire-entanglements. Even where every man has been provided with nippers the toll of death has been so heavy in removing such obstacles that reliance is now chiefly placed in explosive means of destroying entanglements. The present war has declared as obsolete the various ingenious schemes for pulling down wire fields with giant rakes or for bridging them with boards or planking. The toll of life is too enormous. The pole or tube system is much more efficient and less bloody. The pole used looks very much like a colossal rocket: it is hollow and loaded with sections of some high explosive based on picrid acid. The mast-head is capped with steel and fitted with rollers so that it can be flung under the wires and steered properly into the trap. A fuse is attached to the near end of the

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How a French turret fort looks after facing the fire of German 42-centimeter artillery.

pole. Well-placed such a pole will explode a breach in a barbed wire trap large enough for a squad of men to walk through abreast. An attempt would be made to explode the trap in as many places as possible at the same time in order to force a general advance of troops through the breeches made. Assuming, then, that the enemy would be routed from his first-line intrenchments by a combination of explosive wire poles, searchlights, shell illuminants, and rapid artillery, all subservient to an advance *en masse* of the infantry, the fight is by no means won. If the distance gained is sufficient to emplace siege artillery, and leave the reduction of the fortress to the care of the big "Brummers," the next general advance of the infantry would be timed to coincide with the breaching of the armoured turrets. Before this point could be gained the enemy's infantry, unable any longer to prevent the emplacement of superior hostile artillery, would have abandoned its positions in most instances, and its rear guard would be busy with sappers and engineers in securing new intrenchments for the retreating divisions.

Mining and Counter-Mining

In case the Germans had no siege artillery heavier and more efficient than that in hostile forts, the attack would be pushed home by repeated infantry assaults in connection with sapping and mining galleries. The latter are virtually tunnels that are dug and timbered the same as in mine practice, leading up under the base of the fort. A heavy explosive charge is placed in the tunnel head and is detonated by electricity when the storming of the fortress is ordered. Simultaneously with this explosion, which may be counted on to open up the fort, the infantry would advance to the attack with bayonet fixed under the support of shrapnel fire while luminous shell and searchlight turn night into day. The danger of mining is so apparent that all the great French frontier forts have sought to protect themselves against it by a system of counter-mining. A shaft is sunk under the fort and galleries or tunnels radiate from it in various directions. Some of the galleries have transverse tunnels, the idea being to cover as much of the underground terrain as

possible, to prevent the enemy from driving home his mine galleries. Men are posted in the counter tunnels with sound detectors, and as soon as the position and direction of the hostile gallery have been decided, explosives are placed in the counter gallery and detonated. And thus the attack would be advanced by degrees until the storming party would be successful in carrying the fortress by assault or the garrison is saved by reënforcements. In either event the final decisive operations would be intrusted to the infantry arm, no matter how heavy the artillery might be on both sides.

CHAPTER VI

THE WIRELESS SIGNAL

Nietschevo!

It is night on the Polish frontier. Toward the southeast there is a line dotted by the campfires of the Russians, bivouacking under the cannon of Novogeorgievsk. The night breeze wafts the fumes of the kindly fires across the deserted harvest fields where the peace of utter desolation reigns. Mounted patrols are posted in the distance. Beyond them, scattered over the terrain in a wide arc, are the pickets—lonely soldiers in long tunics peering into the night with bayonet fixed, alert to the slightest sound or movement behind the curtain of impenetrable darkness whence the Prussians are expected.

The night passes without disturbance. The bugles of the fortress call to reveillé. Patrols are relieved. Pickets are changed. As the morning haze begins to lift it discloses a double screen of scouts deployed behind cover in the distance, but as far as the eye can reach there is no sign of an approaching enemy. Toward the north the curtain of mist rises somewhat more tardily, lingering around a few

scattered haystacks. The quartermaster is short of forage, and the commander details a squad of men to requisition the fodder. The men advance with teams of wagons. Suddenly the officer reins in his horse. He gives a command. The men unsling their rifles and fix bayonets. The officer dismounts and leads them forward in skirmish line, his eye intently fixed on one of the haystacks which has grown a top-piece overnight in the shape of a tall pole with a cross-tree. A second command in rasping Russian brings the men up on the double-quick. Wires are now visible, glinting through the haze and stretching from the cross-tree to the earth. The last fifty yards is covered with a rush. The stack is surrounded by a cordon of bayonets with panting soldiers at the ready. The officer draws his revolver and shoots into the stack. There is no response. He steps back and deploys his men into a firing-squad. A volley is ordered and fired. Still no response, except for a scurrying rustle of mice. The squad pulls up and begins to inspect the stack at close quarters. A hole is discovered on the north side. The officer crawls into it revolver in hand. He finds himself in a small hollow den and stumbles over a wire. Something clicks and falls heavily to the ground at the same time. The officer withdraws, wire in hand, following the direction pointed by it. With the frail

metal thread in his hand the officer is led afield for several hundred yards to a point where the little wire has been spliced into a larger wire running straight to the Russian headquarters.

The officer straightens with a jerk. At last the extent of the damage is clear. The headquarters' field wire has been tapped, and the orders affecting a whole army corps have been flashed by portable wireless to the German field headquarters.

The officer returns to the haystack on the run. The Siberians have pitched the straw with their long bayonets and stand in open-mouthed wonder around some strange-looking instruments which they have uncovered. None of them know what wireless means; none of them can read. But the officer knows and he can read. He pounces upon a tag tied to the manipulating key of the transmitter. It contains a one-word message, written in Russian but in German characters: Nietschevo! *

* "Nietschevo" is Russian for "Never mind."

Intentional Interference Is Practicable

When the minutiæ of this war are chronicled the world will be astonished to learn of the utility of the wireless signal in decisive moments. Although it is not generally realised that Hertzian waves compare with the waves of light in speed, the popular faith in wireless transmission is much better established than the public's knowledge of the manner in which it is made use of on the field of battle.

In the savagely contested struggle for supremacy on the Ypres terrain the success of the initial phase of the German action depended, in a large measure, on a wireless message, which was intercepted by the Allies. It revealed the fact that the Germans had been strongly reënforced at the very point selected by the enemy for a counter-offensive. The tapped signal prevented a large Allied force from marching into a carefully baited death-trap.

This method of aërial interference is called

"jamming," and though military men have shown little credence in its practical application it appears that there have been several instances where jamming succeeded, especially when the atmosphere was heavily loaded with continued communication. Technically, it should be well-nigh impracticable to disrupt wireless conversation even when greatly superior wave motion and a variable scale of wave distance are employed as a means of intentional interference. Against such an onslaught there is little elemental protection, but in most cases skill in transmission and coöperative appreciation between the operators of method and usage are the technical qualifications that best insure a wireless code message against hostile interference. Sometimes atmospheric conditions cause periods of unintentional interference when all wireless conversation must cease for a time. The experienced commander is prepared for such an emergency with a subsidiary equipment of field telegraph outfits for long-distance, and couriers drawn from the cavalry and the motorcycle arm, for the shorter distances. When the barometric disturbance is not too violent aëroplanes are, of course, always avail-

able for transmitting messages, and at night searchlight signals are sometimes resorted to.

The main utility of wireless service in the present war is divided between long-distance intelligence work and short-range reconnoissance duty. The operation of the intelligence function is well-known and does not differ essentially from the established routine of commercial wireless telegraphy. The general staff keeps in touch with the general field headquarters by the same methods, and under practically the same conditions, as govern communication between commercial stations. The only noteworthy divergences are that while the latter are chiefly occupied with volume of business, the military stations are more vitally concerned with the accurate and unmistakable dispatching of relatively few messages under code conditions of comparative secrecy.

Secrecy Depends on Skill

Observers at the front agree that the essential requirement for secret communication, as far as the station equipment is concerned, lies in the skill with which the wave-length can be sub-

jected to rapidity of change without entailing the risk of confusion. This is the weak point in wireless service. Even temporary confusion has been known to result quite as disastrously as intentional interference by a hostile station. Only by the closest coöperation between operators, and their intimate understanding of mutual methods, is it possible to counteract the inevitable tendency toward confusion under the present system of transmission. Military men who have watched wireless operations on the Franco-German battle lines are of the opinion that while it is a mistake to have the transmitter sharply tuned it is desirable to have the receiver capable of being very acutely tuned; also, in altering the wave-length, either in transmitter or receiver, it is advantageous that the apparatus should be equipped so that these alterations can be made rapidly by operating a single handle controlling all circuits.

In war practice the various stations are syntonised to slightly different wave-lengths, making it a troublesome matter to attract attention. The operators on the firing-lines use as few waves as possible since all variations are not independent, and also because a flat-tuned hos-

tile station will almost invariably cover an appreciable range of these wave-lengths necessitating the employment of a wave-length differing from that of the hostile station by about ten per cent.

Field Wireless Equipment

The French army regulations provide for wireless service between general staff headquarters and army corps, connecting these with cavalry divisions and lines of communication. Unlike the German organisation there is no provision for wireless service within the lines of army corps nor within the lines of infantry divisions. Apparently the chief dependence for intelligence service in the battle zone remains with the aëronautical corps. This explains, in a measure, the paucity of hostile aërial attacks upon German bases as undoubtedly the French aëro corps have been engaged almost exclusively on reconnoissance and communication duty within the army lines.

The war strength of wireless companies in the French army amounts to 10 officers and 293 N. C. O.'s and recruits; English companies com-

prise 12 officers and 293 N. C. O.'s and men; German companies are a trifle heavier. The French organisation, which is the parent model on which other armies have planned their regulations, provides for one general headquarters, 6 sections, each consisting of 2 detachments, or a total of 12 detachments together with a park. The English organisation is by 2 headquarters, 7½ detachments, consisting of two divisions each, or a total of 15 detachments exclusive of the park. A French wireless company carries 302 miles of wire and cable, or fully double the material of an English company, which is dependent for its quota of 600 miles of wire on the army transport. A French company carries 96 sets of instruments against only 45 carried by an English company. The pace of construction in both armies is 3 kilometres per hour; the rate of operation is about 400 words per minute.

The material is transported by four classes of wagons, usually horse-drawn. The office wagon is the executive base. The pole wagon carries the sections and fittings out of which the telegraph pole is improvised. The other wagons supply tools, repair material, cable and wire,

etc. In field operation the responsibility is divided between an officer who plots the route, a sergeant who overlooks the work, N. C. O. distributers who issue material and check the amount used, operators for working the apparatuses and bicyclists serving as orderlies for breaks in the line. Besides, there is a corps of pole-men and cable crew who pay out the cable, guide it over the terrain, make joints, dig holes for the poles, and raise the same in position. The construction corps work in squads. The first squad builds the line, working 100 yards in the rear of the wagon; the second squad strengthens the line, working a quarter of a mile in the rear. The mast sections used for the pole are the result of much vigorous experimenting. Those in use at the front can withstand the strain of a wagon being driven over them. The sections consist of hollow, wooden pieces, hexagonal in shape, having a cylindrical hollow space inside into which are inserted connecting sleeves of drawn steel tubing. Such a pole is very handily erected, even in rough weather, by a force of 4 men in about 15 minutes. The pole entire is carried in sections on a specially made limber wagon. The largest

portable military wireless station in regular use is of 1½-kw. capacity, with a maximum range of 200 miles. The total weight, including cart and crew, is about 750 pounds. It requires only 20 minutes to pitch such a station and get it into working order.

Rather than beguile the reader with a dissertation on the respective functions of syntonisation tests, tuning inductance, jigger primaries and potentiometres, I dare say an outline of the various types of wireless outfits now being used in battle action would be more useful to an understanding of how wireless service is being rendered by the different arms.

The Knapsack Wireless

What is known as the "knapsack" station is the most easily manipulated of portable wireless outfits. The whole station is packed into 4 haversacks averaging 20 pounds for each load, or a total pack of 80 pounds. Thus disposed four soldiers can easily carry a whole station on the march, but, of course, the apparatuses are not used except for scouting parties in widely deployed formation. When such

parties are accompanied by mounted patrols the station is carried in two packs on horseback. Every component part of the station is compact, weatherproof and easily accessible. Only short wave-lengths are employed, hence elaborate tuning is obviated and simplicity insured in operation. The knapsack outfit has demonstrated a remarkable degree of utility in the present war. For replacing mounted orderlies, and such visual signals as are ordinarily used for patrol duty, there is nothing like it. Small as the station is it has a range of from 5 to 7 miles, and can dispatch more information in ten minutes within this radius than a whole squadron of orderlies riding at the gallop. Fitted with this device a scouting patrol can creep up pretty close to a hostile position and report its observations instantly without fear of detection, which would be unavoidable if visual signalling were resorted to or the slow methods of mounted orderlies were attempted.

The "marine landing" station is thus termed because it is designed for the use of such landing parties as naval vessels may dispatch for shore duty, either independently or in coöperation with a military force. The apparatus is

considerably more powerful than that of the knapsack calibre and admits of conversations up to 50 miles. The entire outfit is transported on two special carts and the motive power is furnished by marine soldiery.

The Aëroplane Wireless

The most modern type of scouting aëroplanes in the present war carry specially fitted aërial wireless stations that enable them to keep in touch with aërodrome bases and report observations to the field headquarters. Most of the parts of this outfit are distributed in the hull of the aëroplane; only the manipulating key and the control switch are visible. The receiving station is very compact and has a small pole connected with a trailing wire having a safety plug. For extended reconnoissance, especially in cases where the aviator could not hope to return for added information and get away alive, and when all the scouting must be done at high pressure, the aërial outfit appears to have scored many notable successes at the front, especially in the German lines. Actual war conditions show that no aviator is safe

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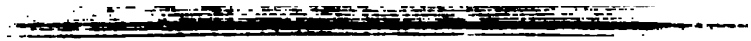
The German Kronprinz inspecting a field telephone outfit. The Kronprinz is in Hussar uniform and turning his back.



from high-angle rifle fire below the 1,200-yard limit, and double this altitude is essential to avoid the fire of anti-aërial artillery. This makes accurate observation of an enemy intent on hiding his slightest movement a matter of extreme difficulty, and most of the aviators who have lost their lives in scouting flights are those who have ventured below the safety zone to improve their observation.

The Army's "Wireless Whiskers"

The cavalry wireless, or as the troopers say the "wireless whiskers" of the army, has shown a surprising degree of efficiency at the front. The mounted wireless squad has been able to keep pace with the regular cavalry under the most strenuous conditions. It can follow anywhere cavalry can go—and that is practically everywhere—and in less than 10 minutes establish communication upward of two days' marching distance.

In the allied armies the second regiment of every cavalry brigade has a wireless detachment consisting of 4 troopers, 1 cyclist and 3

horses, besides a horse-drawn wagon for each brigade. Each cavalry division has a squad of 6 cyclists fitted with tools and material for destroying or repairing lines of communication. The wireless detachments of the German uhlan and dragoon divisions that preceded the advance into Belgium and France were considerably heavier in equipment as well as in men.

The regulation cavalry wireless outfit is carried on 4 horses at an average load per saddle of 160 pounds, or a total weight of 640 pounds. The radius of communication is about 30 miles; the time required to unpack and erect the station is only 10 minutes. The method of loading the pack is very ingenious. The generating set is in position on the pack saddle frame, the rigid saddle frame being removed from the horse and placed on the ground for working. One horse carries the engine strapped on one side of the saddle and the electric generator on the other side. Distributed on either side is a supply of 2 gallons petrol and ½ gallon lubricating oil. Another horse transports the transformer on the left and the receiver with all accessories on the right. A third horse is loaded with pole-sections, spreaders and ground nets. A fourth

horse packs on the left pole-stays, halyards, anchor pegs and on the right side the aërial wires and primary oscillating circuit of the transmitter.

The Automobile Wireless

The French army has developed what is perhaps the most extraordinary example of a practical automobile wireless station for field service. This outfit is entirely self-sustaining, transports its own crew of a dozen men together with provisions and material, and has a travelling radius of upward to 250 miles before extra fuel and provisions are necessary. The radius of communication is about 200 miles, and the endurance is 5 hours on a single charge. Not only is the car containing the station completely inclosed, but the walls are double and lined with wadding in order that the noise made by the apparatus in action may not betray the location of the station to the enemy. There are demountable sleeping quarters within the car for the accommodation of the crew. The motive power is supplied by a 4-cylinder, 16-horsepower motor, having four speeds forward and one rear-

ward. The brake gear is unusually efficient, and solid tires on wooden wheels are used. The pole sections are loaded on the roof of the car. To the pole-head is attached the antenna, consisting of 6 wires whose opposite ends are anchored in the ground. The ground connection is made by means of steel netting, and a special wire connects the pole-head with the station car. A 500-cycle alternating current is used for dispatching messages. By means of a micrometer screw it is possible to gauge the sparking intervals very handily, which is of advantage in modifying the intensity of the current exciting the antenna; neither is it necessary to retune the latter to alter the wave-length. In fact, the apparatus is so flexible that signals varying in wave-length from 200 to 2,500 yards are received without difficulty, thus greatly enhancing the adaptability of this ingeniously contrived station for field work.

Portable vs. Permanent Stations

Although the practical application of efficient portable wireless outfits to military needs is less than three years old, the advance made can

best be appreciated by comparison with permanent stations. First-line battleships in the United States navy carry stations of 5 kw. capacity and 425 miles wave-length. The *New York* [code letter: N M I] is an example of this class. Second-line fighters like the *Kearsarge* [code letter: N I P] cover the same wave-length on 2-kw. capacity. The Siasconsett, Mass., station [S C] covers 350 miles on 2 kw., while the Mare Island Navy Yard, Cal., [N P H] has a wave-length of 900 miles on 2½ kw. Contrast with these permanently equipped stations the 200 miles' capacity of the 1½-kw. portable military outfit, made ready for use within twenty minutes, and the achievement made in adapting and perfecting transportable units is evident.

"Sealed Orders" by Naval Wireless

In general, wireless service has benefited military operations in the manner of an improvement over the field telegraph and telephone, which in turn dispense with mounted couriers to a great extent. It is when we consider the intelligence needs of the navy that wireless serv-

ice appears not only as an improvement but as a revolutionary agent. Formerly a squadron on the high seas had no communication with its base except by means of swift cruisers, and even this slow and uncertain connection was subject to interruption and delay by rough weather and sea fog. Nowadays a sea-going squadron is in daily touch with its base, or connecting relays, irrespective of distance and regardless of the elements. Sealed orders have been made obsolete. The strategy board of the admiralty issues its orders to the fleet commander by wireless command, whether he is at anchor in the roadstead or cruising on the high seas.

In the matter of secrecy and speedy delivery, however, the wireless still lags behind the telegraph and the submarine cable. Many experienced commanders are frankly opposed to it on this account, and prefer to rely on cruisers and cable connections whenever possible. The *Goeben* escape off Messina has proven what such authorities feared that intentional interference, if not purloined codal secrets, might become an objectionable factor. Adroitness in manipulation, however, will prevent interference in most instances, or, at least, it will pre-

clude the possibility of the enemy using his wireless while engaged in the noble work of "jamming" one's own, but there is no known cure for credulous and gullible commanders. Wireless service is now so closely wedded to modern naval needs that a commander who should venture to completely dispense with it in preference to cruiser and cable connections would soon find himself outmanœuvred on the high seas by an opponent equipped with wireless. When the aërial signal is finally developed to a point where it may compare with the telegraph in speed and secrecy of delivery, there will be no need for any other messenger, at least not in the navy. If the wireless telephone, meanwhile, is brought to a point when persons other than unmannerly expert operators may attempt to use it with some degree of satisfaction, perhaps the future will reveal intercommunication between the vessels of a fleet on the high seas by wireless telephone, and long-distance shore communication of the flagships by wireless telegraph to the exclusion of any other connection. There have been several instances when naval operators have conversed by wireless telephone over distances upward of one

hundred miles, but less than half of this radius would be adequate for fleet manœuvre were the service in a state when one might depend on it under any conditions, which it is not.

The Naval Time Signal

There is one man aboardship who was never known to say an unkind word about the wireless, and he is the navigating officer. That man knows exactly how it feels to be responsible for a ten-million-dollar ship and not know exactly his position on the chart. The wireless time signals, which the principal shore stations are dispatching nowadays as a matter of routine, are of conspicuous aid to navigators, both merchant and naval. By a system of pre-arranged rules, simplified to code, the big shore stations issue time signals at fixed intervals that enable navigators on the high seas to check the accuracy of their chronometers. Thus the great German station at Norddeich [K N D] in the East Frisian littoral, having a radius of no less than 2,600 miles, gives the 12 o'clock midday signal by a 3-minute warning to get ready, then four series of 5 dots, rhythmically ren-

dered, the final dot of which is the noon hour to a dot! Similarly the Eiffel tower at Paris, with a radius of 2,000 miles, volunteers the midnight hour. The Poldhu station in Wales is effective upward to 2,200 miles and the Clifden station in Ireland 3,000 miles. The largest radius is covered by the famous Eilverse station in Hanover with 4,000 miles. The three most powerful wireless stations commanding the Mediterranean are Cadiz 1,500 miles, Madrid 2,000 miles, and Catano 2,500 miles. While the German station at Tuckerton, N. J., is equipped to carry messages across the Atlantic Ocean, most of the British stations are designed with a view of supporting fleet manœuvres in the North Sea. Between Dover and Lerwick there are upward to a score of short-range wireless bases in constant operative touch with the British navy and the admiralty offices in London.

CHAPTER VII

THE FOUNTAIN PEN

The Newspaperman's Confessional

First Chronicle.—Our left wing suffered all day from a murderous onslaught of protesting German-American citizens intent on "both" sides and the "real" news [as if we knew!], but toward evening we fell back on intrenchments prepared by our indefatigable corps of foreign correspondents. Our "big guns" established the fact that the Crown Prince Rupprecht of Bavaria was discovered in a smart hotel at Munich in the act of showing his newly sharpened sabre to his wife, who seized the sabre and kissed the blade, exclaiming—"Bring it back covered with blood that I may kiss it once more!" Splendid lead for editorial on German barbarity and cruelty. Luckily our strategic position is such that no one stopped to question whether royal personages are really in the habit of making "smart" hotels the scene of their rendezvous. It developed later that since the Crown Princess died two years ago it was a tactical error to use the story as news, but we were able to cover our exposed position by

subsequent screening operations with a force of war poets and window-cleaners.

Second Chronicle.—We saved our centre from being pierced to-day by a furious advance in the price of beans, and only the dare-devil courage of our composing-room patrol saved a two-column advertisement from utter annihilation. The masterly retreat conducted by our editorial department amounts to a victory in itself since it extricated us from an untenable position and furnished our forces with a new point d'appui resting firmly on a non-inflammable waste basket and the office cuspidor. Thus intrenched we were able to shell the enemy at leisure, and our cavalry patrols in Whitehall Street [England] unearthed a strong story showing how the fumes of the French shrapnel sometimes asphyxiate the enemy.

In a drawing-room of a French château a company of German jägers were discovered in a state of absolute petrifaction. Some stood at the window in the act of taking aim, others sat around a table joined in a game of cards, still others retained cigarettes between their lips, and the lieutenant had his mouth open as if about to issue an order. The life-like expression of the corpses was astonishing. We scored quite a beat with this interesting story, and I enjoyed it myself until a military man spoiled my taste for it by telling me confiden-

tially that soldiers are not allowed to smoke or play cards in the presence of an officer, nor would they be likely to indulge in that pastime if the enemy was so close that they could actually shoot at him from the windows! As this information was confidential I did not impart it to our readers, of course, but I made up for it the next day by reducing a German defeat from 132-point full-page spread to a modest 3-column head! Our vanguard is retreating masterfully despite the morale of the office, and our rear-guard is advancing inch by inch beyond our skirmish line, supported by double columns of worn type and scare-heads.

Third Chronicle.—A wounded "constant reader" was brought in on a stretcher during the lunch hour. We revived him with a drink of absinthe, but when the poor fellow saw the bottle he keeled over and met his death patriotically, being a German. Sauerkraut would probably have saved him. All of which reminds me that our nation is in a "state of public peril" [phrase copyrighted] and that it behooves us to maintain "complete neutrality." Strong stuff, this neutrality gag. The circulation manager tells me it sells the paper beautifully! Our offensive-defensive is now so solid with the readers that we can afford to use blank cartridges for a while. When the interest begins to flag we shall move on the earthworks

of public opinion with poster type and scare-heads, supported by flying wedges of facts in massed bodies, and electrify our readers by showing that all the while we were proclaiming ourselves officially neutral we maintained a rollicking trade in war munitions to the allied belligerents. This exposé ought to qualify me for the presidency or something, and if our columns will stand the strain the paragraphs will take care of themselves.

Our army continues victoriously despite ice in the Baltic and broken type in the composing-room. We remain adamant toward the intruder who was discharged for spelling "Przymyzl" correctly, but as he cannot pronounce it nothing would be gained by taking the insolent fellow back on the force. We are crippled by erudition in all departments. What we want is oratory, especially in the composing-room, but we are also willing to engage a few military experts who can show honourable discharge papers from prominent shoemakers and fashionable greengrocers.

Fourth Chronicle.—An almost inhuman attack was launched at the ghostly hour of night against our exposed right wing, charging us with attempting to turn the flanks of veracity. In this emergency we have armed our office boys to the teeth with squirrel guns and horse-pistols, and expect soon to hear of developments in the

Bukhovina. Our outposts debouch magnificently [not in the literal sense, however]. Last week we buried the old Field Marshal von Moltke—got kind of tired seeing his phiz on the front anyhow—and this week we have scheduled old man Emmich to commit suicide for the second time [and this time we will see that it "takes" even if our commissariat runs out of red ink and scare type]. Besides, we have listed that goose-stepping brother von Kluck for capture; we have repeatedly defeated this fellow with "special extras" while he was advancing through France, and we are a bit tired of his antics. Those "dead" ones, von Bülow, von Heeringen and von Haussen, have no business to be mentioned any longer, but I am going to keep on declaring the Crown Prince as dead as a door-nail until he actually dies—in order to be the first man on deck with the news!

Our strategy continues to receive the plaudits even of our enemies. The deployment of our scissors-squad right in the nick of time to save our 42-centimetre paste-pot ordnance from summary invasion and capture was so accurately timed that not a single subscriber was lost in the carnage, though at one time it seemed as though nothing could prevent the enemy's trumpeters from sweeping our counterscarps with listerated gum and peanut-shell. Led by the janitor our cavalry screen made a historic

attack on Lille, turning off the gas in that city and plunging the enemy into utter darkness. Next to the exploit of our blind compositor, who defeated a whole regiment of German jägers with a French prize bull that had been unnecessarily goaded by sticks of Limburger cheese, we can recollect no front page victory that can compare with it.

Fifth Chronicle.—We have indorsed the stand taken by our Secretary of State that United States does not need a large army because the efficacy of chewing gum and grape juice is such that a million armed men can be stamped out of the ground in twenty-four hours. We do not see how this is possible but we take the Secretary's word for it, as he was once a colonel and ought to know. We are also boosting the plan to turn the United States Navy into a sort of toyland for tin marines and wooden sailormen, as this would enable us to save the huge expense of building modern vessels and permit the gradual adoption of old wooden hulls. If the Swiss republic can get along without a navy, the vastly more powerful American republic certainly ought to be able to defend itself with fishing smacks and garbage scows. We are not posted on the technical questions involved, but are quite content to take the word of the Secretary of the Navy, as he was once a farmer and ought to know.

Blundering Correspondents

THE theatre of war on both fronts is so immense, and the theatre of operations is so complex and multiform, that it is not feasible to furnish even a meagre outline of the events. Some day a whole library will be written in detailed analysis of the latter. In the brief space allotted I shall limit myself to the corrective task of pointing out some of the blunders that have been made by correspondents in reporting military operations and events, especially such as appear to have made an impression on the American public.

While I was writing editorial analyses on the war for some New York newspapers I was repeatedly asked to define words like "counterscarp," "point d'appui," etc., and one dauntless correspondent dispatched a bundle of clippings in which he had marked the word "strategy," which appeared frequently and in the most surprising connections, requesting a definition to "fit all cases"! In a land gasping under the weight of ponderous dictionaries, and

at the same time harrowed by weird and unfamiliar pronunciation, one becomes inured to surprise. Indeed, the word strategy has been used to denote the movements of patrols, of aëroplanes, of signalmen, of individual commands, anything, apparently, from pistols to carrier pigeons.

Newspaper Tactics

It has been said that there are no surprises in this war, but it seems to me there has been nothing but surprises. How otherwise is one to account for the Allies winning all the "victories" while the Germans were chasing them through Belgium and France to the very borders of the Marne! The censored reports showed very plainly that the German advance was of no strategic importance, and that the "masterful retreats" of the Allies would eventually solve the situation. The American newspapers allowed themselves to become hypnotised by the censored accounts from London to such an extent that the most brilliantly conducted offensive campaign in modern warfare was distorted into a series of German defeats.

In their eagerness to follow the hint from London, whence they are accustomed to go in quest for every scrap of foreign news, they even out-Englished the censor and "forgot" to report the actual dates of the German occupation of strategic points. There is one New York paper in undeservedly good standing, which has not even at this date admitted the fall of Liège, while there is not one who has not reported, on several occasions, the capture or death of men like von Moltke, von Kluck, von Emmich and even the Kronprinz!

In fact, the American press, in utter ignorance of the magnitude of the task involved, and as nonplused as a boy on beholding his first elephant, did the very thing it should not have done, and dispatched a gang of men to the front, thinly disguised as "war" correspondents, who were about as fit to record the operations of modern armies as an American cowboy would be to report a sitting of the naval board. With one or two exceptions these men must be classed as incompetents. Some of them had served in previous campaigns by disclosing their utter lack of military training and knowledge—which did not matter so much

with a non-military audience and editors intent on "stories" rather than fact—and most of them could not tell the difference between a sword and a sabre. To this corps of "rocking-chair" civilians, trained in the gentle art of turning molehills into mountains, the American people is indebted for the harebrained and amateurish manner in which this war has been reported. The logical thing to do, it seems to me, since press censorships were established abroad with the obvious intent of passing only favourable news, would have been to establish a board of analysts on this side, composed of authorities skilled in military and naval warfare, and let this board sift the censored reports before the press would turn their staffs loose on the material. A military censorship is only the strategy of the intelligence service in condensed and emendated form for popular consumption. It cannot be gotten around by detachments of newspapermen—even if they are competent—because first-class powers do not allow them at the front, as I pointed out at the outbreak of this war. But this is not the first war which has been misreported. Any one who is anxious to convince himself on this point

should compare the war correspondence of the British-Boer conflict and the Russo-Japanese campaign with the military reports of the contestants on both sides. The former is largely fiction, the latter are based on fact. The space allotted here is too brief to admit of even partial exposition of the woeful mistakes made by correspondents in this war. I shall limit myself to a few examples that must be fresh in the mind of the readers, and which plainly show that the correspondents are ignorant of even elementary knowledge of warfare.

Newspaper Cavalry

German cavalry has been referred to as "uhlans," as if it consisted exclusively of this arm. It is true that *les uhlans* of Frederick the Great impressed themselves so indelibly upon the Gallic mind that the term became synonymous, in a popular sense, with Prussian cavalry, but no military man would employ such a misleading phrase. There are no less than four classes of cavalry—hussars, uhlans, dragoons, and cuirassiers—and all of them were engaged, the hussars and uhlans forming the light arm of

the cavalry. Some correspondents have persisted in using the phrase "lancers," evidently taking their cue from the British field scribes, but as all four classes of German cavalry are armed with the lance, this term is even less descriptive, as well say "horsemen" and frankly own up to ignorance.

Fake "Field" Reporting

A deployment of skirmishers is glibly reported as an "invasion." An encounter between advance guards becomes a "battle." The masking of a fortress is exaggerated into a "siege." The operations of a corps are magnified into that of an army. If it advances it is "victory," if it retreats it is "defeat." Between these extremes there can be no distinctions, at least not in a mind innocent of the tactical operations whereby an army disposes its forces for concerted action. When the heavy German and Austrian siege artillery appeared at the front it was described in the hysterical phrase of a fugitive vainly trying to picture a bombardment. A train of denials and counter-denials followed, but the big guns,

which constitute a surprise and a good "story" in themselves, were not adequately described. The judgment passed on prowess and discipline is unintentionally amusing. Again and again German soldiers have been berated for their "cowardly" action in "running away" when their officers were shot by aspirants for "best-sellers" fame who do not know that a standing order [*vorschrift*] in the German army is that troops finding themselves without commanders under action must fall back and place themselves under orders immediately. In the same breath the correspondents would refute themselves by stating that the German infantry charges were so fierce that the men chopped their way through barbed wire traps and continued to charge against the glacis of the forts, in the face of a withering fire, until they were stretched low on the very parapets!

Fake "War" Photographs

The inscriptive skill displayed on "war" photographs shows that though modern guns will carry far, bluff will carry still farther. For about three months this country was flooded

by printed reproductions of photographs taken at least one year ago at French, German and British field manœuvres. The old inscriptions were crossed out, and new ones were concocted to fit present needs. In his famous hurry the "head-line" artist would sometimes confuse the nations a bit, as when he would label French infantry in skirmish line as "Austrians Moving to the Attack!" and French troops have frequently been ticketed Belgian. However, these are mild offences when compared to photos of the *Karlsruhe,* described as a German "battle cruiser," squadrons of Belgian lancers masquerading as "German uhlans," and those memorable prints of French cuirassiers dignified to posterity under this delicious inscription —"Armour Plated Suits for Kaiser's Men!"

Under the caption, "Terrible French Cannon Aims and Destroys Itself," a newspaper syndicate scattered broadcast a narrative so entirely improbable as to be unintentionally amusing. The illustration embellishing this *chef d'œuvre* of anticipatory reporting was nothing more or less than the standard 155-millimetre field gun of the French army. Suffice it to say that its inventor, Colonel Rimailho, would be the last

person to approve the startling claims of this intrepid "story."

Some Typical Yarns

Another "find" was the noble series of "saw-bayonet" lore, with which a tremendously famous "double-star" war correspondent burdened the cable at great cost to his unsuspecting paper. This happened at the time when the world had practically decided, aided ominously by the British press censor, to single out the Germans for barbarous methods of warfare. There was not the ghost of a doubt but what Prussian soldiers had been caught in the act of severing the heads of perfectly well-behaved French soldiers with "saw-bayonets," a fiendish weapon specially made for this purpose. The mere fact that the correspondent succeeded in finding two specimens of this weapon in trenches formerly held by the Germans was considered ample proof of unpardonable barbarity! No one even inquired why it should be considered advantageous for a soldier to engage in the slow and tedious process of sawing his enemy in two when a well-placed jab would finish him, entirely

aside from the fact that he who would attempt to do the sawing would certainly be jabbed to death before he could finish the job! If that double-starred manipulator of mistakes had but known that the corporals of a German company carry so-called "saw bayonets," for engaging wire entanglements and cutting away the underbrush, and that the saw blade is affixed to the rifle to gain added leverage, but certainly not for decapitating human members, it is possible his readers would have lost a "beat" and captured a fact.

The dum-dum bullet thrillers owe their origin to similar misconceptions. None of the nations engaged are in the manufacture of dum-dum bullets. Personally, I do not believe that a single bullet of this description has been issued to a single soldier in this war. What the soldiers themselves may have done in the way of denting or filing their bullets is quite another matter, but if this has actually been done, to any noticeable extent, even a layman must admit that the soft-nosed French bullet lends itself to being tampered with a good deal easier than the steel-jacketed German bullet! Besides, the standard type of bullet cannot in all cases be

depended upon to make only cleanly-perforated wounds. When fired at long range the bullet may deviate slightly before it strikes the body, or the soldier's clothing and accoutrements may cause it to swerve and "keyhole" after striking; in either case the wound caused will resemble the mushroom exit of a dum-dum missile. But, perhaps, data of this sort would not constitute a "story."

When Ought Counts Naught

If all the errors and mistakes were collected and collated with such material as would be afforded by the misrepresentation, wilful as well as unintentional, as appertaining to the issues of this war, we should have a volume that no man who has ever borne arms could resist.

Especially is this so if the volume would include a comparative statistical survey of the estimates of casualties and losses furnished by correspondents. Imagination is a tame term to describe the activity exhibited in this field by knights of the scissors and paste pot, capable of creating six-cipher earthquakes and four-cipher conflagrations on the hint of a night wire. A

statistician who kept count from August 4th to September 4th, 1914, states that the Germans alone lost about 1,500,000 in wounded, missing, and killed troops in this interim, according to the dispatches printed! That there are any Germans left at all at this writing encourages me to say that the suggested demise of that nation is somewhat precocious, but I shudder when I think what the grand total fatalities of all the armies must be by this time.

The Fountain Pen Duel

As a matter of fact the reportorial fountain pen is a weapon of modern warfare capable of inflicting a good deal of damage. It does not slay, neither does the wireless signal, but its potency is nevertheless so considerable that governments at war protect themselves against it by the iron-rule of censorship. A skilfully manipulated corps of fountain pens can turn a foe into a friend, remove or engender a prejudiced opinion, and generally mould and coach the opinions and sympathies of non-combatant nations in a war of this kind. The German scribes are bidding for American sympathy,

not because Germany cares a hoot what America thinks, but because it is the only great power left that has not declared war against Germany, and it has the only navy that could insure German supremacy on the sea. The Allied scribes are bidding for American sympathy also, to prevent it from being diverted to Germany, and with their control of the cables they have been able to defeat the German scribes in every decisive encounter of the "fountain pen" duel. The United States is nine-tenths prejudiced against the German cause to-day—thanks to the superior equipment of the Allied scribes—and there is not the slightest prospect of an improved sentiment. And this is the crux of the matter: Had the cables remained open, and had it been possible for the German scribes to enter the fight against the Allied scribes with equal means of propaganda, it is quite conceivable that American feeling would be favourable to Germany or at least divided equally between the contestants. From this to actual aid in a financial and commissary way is not such a long step in a nation that recognises no government except that which may, and may not, lie in public

opinion, and once America had committed herself as a covert ally it would not be difficult to embroil her as a belligerent.

The Russo-Japanese war was likewise "handled" by the British cable and correspondence monopoly. So adroitly was the fountain pen manipulated that the American people became enamoured of the Japanese [England's allies], and entirely ignored Russia's claim to some return for her very valuable friendship to the United States in times past. This perverted sentiment found practical expression at the peace of Portsmouth, N. H., when an American president, acting, perhaps unconsciously, as England's tool, compelled Russia to terms that would not have been quite so humiliating to her, and perhaps not disastrous, had the popular sentiment in America been favourable to her at the time.

CHAPTER VIII

THE SUPER-COMMISSARIAT

It happened during the storm-march of the German right wing under General von Kluck against the armoured forts of La Fère. The most advanced position was held by a detachment of Prussian fusileers, who withstood the onslaught during a whole day of incessant engagement without food. The men had dug themselves into flat trenches hastily prepared with hand-spades. They were practically isolated. Two companies had been hurled forward to reënforce them, but the distance was too great and the French and English machine guns mowed the men down as a scythe cuts grass. The German rapid-fire artillery kept up a continual stream of bursting shrapnel against the British left, which threatened any moment to take the isolated German position by storm. Of the two regiments gambling their lives away in that position there was not one man who did not have a dead comrade beside him. Most of the men had been shot in the head. The shallow trenches afforded but little shelter against the galling fire of the British, which clipped

the crest of the earth-screen with the precision of scissors wherever a spike helmet peeped forth. Not only were the Germans exhausted for want of food, but their ammunition belts were getting to be as empty as their stomachs, and they were using the belts of slain comrades. Of the six thousand fusileers in that fire-swept position only two thousand remained, and they were facing what seemed like utter annihilation.

Then something happened that no one will forget who saw it. A big, fat Prussian army cook bobbed up behind a boulder a few hundred yards behind the German position and fired a rocket with a line attached. A stray bullet bowled the big fellow over like a rabbit at precisely the same moment. That bullet deflected the aim of the ambitious chef and caused the rocket to land exactly in the German trench. Quickly the line was pulled in and an enormous projectile followed. A hail of bullets greeted the advance of the gliding missile, but its armoured sides turned every shot very smartly and it was finally hauled into the trench. A tap on the shell, which was of the Skoda 30.2-centimetre calibre, showed that it was not loaded. A wooden cover had been inserted in the blunt end where the priming charge is supposed to be. The cover was dug out, and behold! there was the most appropriate form of ammunition for that exigency, in the shape of

sausages—sausages packed like sardines—the famous "erbswurst" of the Prussian army that makes dying men stand up and goose-step! With a sausage in his left and a rifle in his right it is no wonder that the German fusileers were not routed. Toward night heavy reënforcements reached the position they had so valorously defended.

The fat cook was discovered in the lazaret, where the commander went and saluted him. An Iron Cross now dangles on his proud bosom, but he is not the only cook in the German army who has received and earned it.

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The motor kitchen of the German Kronprinz. The butler is in the act of handing something to an orderly. At the extreme right is the private chauffeur of the Kronprinz; toward the left is his private automobile, painted blue-grey.

"Fighting on the Belly and Marching on the Stomach"

The commissariat of the German army is the most complete and efficient organisation of its kind in the world. It towers head and shoulders above the French, Japanese, English and Russian organisations despite the fact that these bodies have achieved a very notable and genuine progress, especially during the last decade. While her opponents seem to have realised that an "army travels on its stomach," Germany has applied the twofold lesson that a modern army fights on its belly and marches on its stomach. In the German commissariat honours are equally divided between transportation, rapid and adequate, to deploy an army to its destination; provisions, ample and accessible, to feed the fighters; defence by means of pick and shovel, and offence by ammunition and rifle. Not the slightest detail in any one of these departments has been overlooked or scanted at the expense of the service as a whole.

A volume could be written on the operation of each department. Suffice to say that the watchword for each of them has been: service, more service, better service. Every possible, and apparently impossible, exigency has been provided for to secure and maintain maximum efficiency in feeding the imperial troops on the battlefield under every conceivable and inconceivable condition of warfare.

The "heavy artillery" of this branch of the service is represented by formidable field kitchens and bake ovens mounted on four-wheeled trucks and drawn by horses or motor-propelled. In fact, the work of baking and cooking is not disturbed or retarded by the march of the troops, but goes on uninterruptedly as the kitchens and ovens follow in the rear of the marching columns. It was largely due to the perfection of the provisioning branch of the commissariat that the German storm-drive through Belgium and Northern France was made possible.

The commanding officers' mess is supplied by specially contrived automobile field kitchens, complete to the smallest implement. It is part of German field strategy to maintain the great-

est possible degree of mobility in the officers' corps. The commanding officers proceed by automobile and are required to precede the troops and select the battle-ground; hence, motor-kitchens are necessary to follow and feed them. The first Prussian soldiers to break into Belgium were not troops on the march, but a flying detachment of superior officers in high-power motor cars. Then followed squads of armoured motor cars, paving the way for the advance guard, consisting chiefly of cavalry, before the infantry marched across the border.

The most completely equipped of officers' motor-kitchens are those in personal attendance on the Kaiser, the Kronprinz and the Kronprinzen of Bavaria and Württemburg, commonly styled grand dukes. The motor-kitchen of the Kronprinz Friedrich Wilhelm is typical of the field service de luxe. It is almost the size of a London bus and contains a complete kitchen, with cook range, bake-oven, pantry, water cistern, ice-box, china closet, buffet service and what not. Sometimes the Kronprinz motors from the firing-line to the kitchen for his meals in his private field automobile, which is operated by a chauffeur who has the

coolness and skill of a professional racer. At other times the kitchen motors after him and his staff as far as the terrain and the range of hostile artillery permit. Besides the chauffeur there is a cook and a butler stationed in the motor-kitchen, to which one or two orderlies are attached in addition.

"Fleisch, Brot und Wasser!"

The three big items in feeding an army on the march are meat, bread and water. A commissariat which can supply these main essentials in uniform and adequate quantities, and warrant the quality pure, even though many other "necessaries" may be lacking, can keep an army in good physical fighting condition on the firing-line. If the rigours of a winter campaign must be encountered, as in the present war, special equipment in the shape of helmet hoods, mufflers, mittens and socks, all of the very best quality, are issued to the troops in addition to their regular winter equipment as otherwise they would not live to eat the provisions. The general staff of the commissariat has carefully gathered data, based on practical

experience, demonstrating that the most efficiently equipped soldiers, whether for summer or winter campaigning, will invariably prove superior to soldiers inefficiently equipped though inured to the climate. On this theory the German commissariat is fitting out the imperial armies on the Russian frontier for winter-campaigning in such a thoroughgoing manner that the troops may be expected to withstand the severe climate there at least as well if not better than the native Russian troops.

In a campaign like that waged by Germany in its storm-drive into France, every part of the commissariat was sacrificed to mobility and speed. This requirement had a peculiar bearing on the chief anxiety of the provision branch, that of meat. Ordinarily a strong effort is made to supply the troops with beef on the hoof, at least the advanced divisions that are engaged on the firing-line. Fresh beef broth does keep up the strength and courage of soldiers fighting in the trenches when nothing else will. Two hours of uncomfortable sleep out of sixteen spent on heavy duty in all kinds of weather, under withering rifle- and shrapnel-fire, with sudden,

forced marching in the dead of night, only to face worse hardships at the break of dawn, is a combination of evil times that goads the animal instincts of fighting men to a point when their ravenous appetite resembles that of the wild beasts of the jungle. Nutritive capsules and tablets will no more cure hunger of this sort than any of the so-called "health" foods, nor "physical culture" alternatives, nor any of the ingeniously contrived and scientifically concocted dietaries that do so much on paper and perform so beautifully in private tests. A pill can be produced that will contain as much nutritive value as four ounces of meat, but the meat will put more strength in the soldier than the pill. Laboratory experts are in the regrettable habit of forgetting that man is endowed with a stomach that must be filled as well as fed. Mere nutritive value is not enough; volume is quite as necessary. It is the alimentary value and volume of the food that still hunger and make proper digestion possible. Pill schemes and capsule tricks may be all right for anæmic people, but when it comes to feeding a super-army of well-nigh four million men, disposed on two hostile fronts, in which every man is under a

harrowing, crushing strain, physically and mentally, the stomach of man demands the food that Nature has provided for it since the beginning of time. The German commissariat has acted on this basis. It is the soup meat and roast meat made from freshly slaughtered cattle, and served from properly attended field kitchens, that have filled the stomach, quenched the hunger and revived the strength of the exhausted German soldiers, enabling them to do a great deal more fighting in the aggregate, man for man, than the equally brave but less skilfully provisioned hostile troops.

"Kriegskonserven"

To obtain fresh food in adequate quantities means that the commissariat must do a great deal of foraging and for greatly advanced positions maintain a herd of cattle on the heels of the rear guard. In the initial German dash into France, which is unparalleled for speed in the annals of military history, there was no time to forage or stop for anything beyond supplies by rail. No attempt was made to establish a cattle corral. The main supply of meat came in car-

loads, freshly slaughtered, and was loaded, on arriving at the various railheads, into motor-vans, transporting the supplies further to the field encampments. Only when an army corps would make a halt to reduce a fortification or invest a town was there an attempt made to forage and supply beef on the hoof.

To meet the exigency occasioned by the German storm advance, the commissariat fell back on its carefully conditioned, immense store of hermetically sealed beef, soup and vegetables. This branch of the service has been built up by food experts and physiologists attached to the government service. The "Kriegskonserven," as the Germans call them, are prepared in factories controlled by commissary officials. The strictest inspection of the products used is obligatory, and the finished products include everything imaginable from goulash to potted fowl, all kinds of roasts, stews, soups and even desserts. This food is not ordinary tinned stuff, but the very best products the market affords scientifically inspected and prepared with a view of not only stilling hunger and giving strength, but also appealing to the palate. It has been found that an appetising fare, capable of con-

siderable variation, will keep troops in much better shape and spirits than the same alimentary value and volume without the palatable element. Every can and box is sealed and labelled with the nature of contents and date of making. After a certain time the conserves are confiscated and new supplies take their place, the idea being to keep the stock on hand in a perpetual state of absolute freshness. Sample rations of Kriegskonserven have been dispatched to the German colonies in China and Africa and subjected while there to the extreme conditions of tropical climate for long periods of years without the slightest deterioration. During the advance of the seven big armies into France, of which General von Kluck commanded the right wing, enormous quantities of Kriegskonserven were forwarded by rail to the farthest safe point in the rear of these armies. A temporary base would then and there be established at each point, which would accumulate a large stock of provisions. The various army divisions would draw on the nearest available base for supplies, and these were forwarded by motor truck until the steadily advancing army made the distances to be covered by motor transport large enough

to warrant the establishment of new depôts and bases.

The water supply of a modern army is no longer by way of the old-fashioned barrel wagon or the well-bucket. Large motor vans loaded with steel cisterns do the work of allaying the soldiers' thirst. One such truck holds enough drinking water to insure a liberal swig for every man in an army corps, or a force approximating 45,000 men. This means a daily continuous service of twelve big cistern trucks to allay the parched throats of a half-million men. As there are at least four million German troops in the field it would require about one thousand motor-cistern trucks to supply them with water were it not for the system of sterilising and purifying river water by a radio-active process, of comparatively recent invention, which has obviated the use of the "water-wagon" trains to a very considerable extent.

The baking arrangements in the French and English armies differ a good deal from those adopted by Germany, not only in the kind of bread made, but also in the manner of baking. The British commissariat sticks to the earth-oven method, which is perhaps better suited to

the kind of loaves favoured by Tommy Atkins, whereas the German commissariat provides very capacious field bakeries on four-wheeled trucks, drawn by teams of horses. Despite various economies that have been introduced from time to time the expense of the rations necessary to maintain a modern army in the field is well-nigh staggering. A military statistician has computed the total commissary cost of supplies and rations to all the troops of all the armies opposing one another in the field at this writing at more than twenty million dollars per day!

The Wonderful Field Kitchens

About ten years ago the German commissariat came to the conclusion that it was a mistake to issue rations in a raw and unprepared state to troops in the field. It was argued that soldiers that have been subjected to heavy marching or trench duty during the day are quite naturally tired out toward evening, and tired men make bad cooks. At best the rations issued to the soldiers are cooked by them over improvised camp-fires in a hasty and slovenly

manner, resulting in meals causing intestinal disorders, which put many of them on the sick-list. A large proportion of the soldiers are too tired to even attempt cooking and eat their rations raw, thus adding still further to the surgeon's roster. If the soldier could be certain of three substantial meals, at dawn, at noon and at night, properly prepared by skilled cooks, not only would his resistive strength be greatly improved, but also his morale and fighting spirit.

This very logical view led to the introduction of a new type of military field kitchen, the final evolution of which remains to-day the pride and boast of the German commissariat. No army has anything like it. No kitchen anywhere is better equipped to perform the service expected of it. To show how thoroughgoing the Germans are once they make up their minds to do something, I will attempt a description of how they evolved the best portable military kitchen for feeding an army on the march:

Out of forty different models submitted to the German general-staff, which opened the initial public competition in 1905, only two specimen kitchens approached the official re-

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These Austrian field-kitchens were modeled upon the German type, and have given great satisfaction. The lids on the coppers are shown opened and the smoke-stack is mounted.

quirements. A second competition was started containing no less than fourteen separate specifications with a multitude of subdivisions, covering every conceivable requirement from capacity and safety appliances to noiselessness, freedom from explosion, and even "invisible" appearance! The final choice fell upon an outfit of the following description. A four-wheeled vehicle for two horses, the front carriage being detachable from the rear when necessary, and both parts capable of being drawn by the same team. On this truck the kitchen proper is mounted, containing an explosion-proof copper holding 200 quarts in a boiling vat, an explosion-proof 70-quart coffee tank, both receptacles having separate fireboxes and ash-pits. The front carriage contains 200 extra-rations for the men, the daily quota of provisions, 3 extra rations for the horses, folding canvas water pails, driver's and cook's baggage, and besides a saw, pick-axe, hatchet, carriage tools and fittings, stores and stable material. The rear carriage holds the fuel box and the cooking contrivances, such as meat-chopper, coffee mill, strainers, knives and other utensils. The boiling vat surrounds the copper and prevents the

food from being burned and facilitates self-cooking; also, it serves as a hot-water heater. Because of this hot-water immersion method the food in the copper continues to cook as in a steam-kitchen, and is ready for serving at end of normal cooking time. Even after twelve hours the food is found to have a temperature of 148° Fahr., and should the necessity arise for keeping the food untouched even longer, a new fire is made every twelve hours and in this way the contents can be kept fresh and palatable up to within 72 hours or three days and nights. The copper is aluminum-lined and easy to keep clean. The preliminary cooking is done at night and early dawn. After the cooking is completed the men can draw on the kitchen for hot water, and have their canteens replenished with steaming hot coffee. An ingenious arrangement of multiform spigot makes it possible to fill six flasks simultaneously, and as these flasks are fitted on the thermo plan the men detailed for sentry duty are able to carry with them the satisfying hot beverage to their post.

The total weight of such a "feldküche" is about 3,000 pounds, and it can follow even cavalry on the march almost anywhere. It does not

smoke, it is noiseless in cooking and operation, and the fire-box has a marvellous capacity for all kinds of fuels, from coal and wood to peat and briquettes. Owing to the constant heat maintained by the boiling vat the consumption of fuel is very small. The coffee tank and the copper are fitted with strong covers capable of being hermetically locked, and all the drawers and compartments in the front and rear parts of the vehicle have locks and are entirely weather-proof. In an emergency such a kitchen can be taken across rough country, and in rough weather, at a gallop without spilling a drop or wasting a particle of food. As the rear section can be driven independently it is possible even at night to venture forward to the firing-line and feed the exhausted troops in the trenches direct from the kitchen. In the daytime such a manœuvre is usually limited to the second and third line trenches for obvious causes. While the men are being fed from the kitchen the front section of the vehicle is sent back to the rear for fresh provisions.

These horse-drawn field-kitchens, then, together with the motor-propelled mess-kitchens for the commanding officers, and the automobile

kitchen cars for army and corps commanders, constitute the *pièce de résistance* of mobile culinary science on the firing-line. It is by perfected and complete arrangements of this calibre that the German commissariat has succeeded in making one soldier do the work of two at times, whenever the trenches in the Western theatre of war were depleted of men wanted to stem the tide of the Russian invasion.

CHAPTER IX

SUPER-STRATEGY

General "Vorwärtz"!

A big, square-set man is sitting at a table lighted by ornate silver candlesticks. A detail map of the East Prussian boundary is in his lap. Other maps are spread on the table together with calipers, ferrules and other instruments.

In the room adjoining are a number of adjutants and staff-officers. Some of them are gathered about a large dining-table entirely covered by a scale map, showing the minutest variation in the terrain under study. The positions of the armies are marked on the map by tape fastened with stickers. Reënforcements under way are identified by arrows. There is a portfolio in which every move made by any and all of the armies is written down with scrupulous exactitude. An ordonnanz is in charge of the big chart and marks with tape any change made in the positions.

At a small table is the telephone exchange, operated by a N. C. O. The wire connects directly with all the army field headquarters. If

a general commanding an army has anything to report it must go over this wire, but generals in command of army corps and divisions must first telephone the army commander, and if he thinks the report is of importance also to the commander-in-chief he orders it relayed over the direct wire.

In a corner is a portable wireless station. Through the window the mast and the antennæ can be seen. The operators are in constant attendance. Messages received are instantly typewritten in triplicate and brought to the commander-in-chief before any one else is permitted to see them.

The other rooms of the little château are used as living and sleeping quarters for the staff members. The garden lawn has been converted into a military garage, where several high-power automobiles, some of them armoured, are kept ready for instant use. Sentries are posted at all exits and approaches. A mounted patrol is stabled in the barn.

For several days messages have been pouring into the headquarters exciting the buzzers on the telephone and the wireless outfits, sending ordonnanzen scurrying from room to room, dispatching couriers by automobile, and adding tape and stickers on the big war map until it resembles a crazy-quilt. Gradually corps after corps have swung into line, and army after

army has debouched, under incessant fighting, until they occupy the strategic positions selected for them in advance by the big, square-set man sitting alone in the little room.

An anxious moment is approaching. The right wing, which was badly mauled by an overwhelming force of Cossacks, has suffered a setback from which it must recover before the entire field army can operate as a unit. The map shows that reënforcements have reached the right wing in the nick of time, but it has not been able to advance as yet and is merely holding its own. The whole campaign, involving more than a million troops, hinges on the fate of the hard-fighting right. Every time the receiver clicks and buzzes the officers look up from the map and cease talking, but the expected message does not arrive. The big, square-set man is pacing the room with his hands on his back. A frown has settled over his strong, martial face, but he controls himself well and gives no vent to his emotions. For two days he has spoken only in monosyllables, and only in answer to the deferential inquiries of his staff! A lesser man would have been elated at the general advance made by the troops, but this man is aiming for a decisive victory to crush the enemy. Every hour lost by the right wing in re-forming and joining his plan of attack may cost him the battle.

Once more the wireless buzzer raps. The operator does not wait to type the message but dashes it off on a blank, and the ordonnanz takes it to the commander-in-chief. The big man scowls, for the right is not advancing. Suddenly his face brightens with a daring idea. He pens an order commanding the right wing to feign retreat until it appuys on the centre, then to advance en masse!

The ordonnanz opens the door and steps aside. The commander-in-chief enters. The officers in the staff-room stand at attention.

"Gentlemen," he says, "I leave for the front. The battle will be at Tannenberg."

Soon after a high-power motor-car sweeps out from the terrace of the château carrying an ordonnanz beside the chauffeur and an adjutant sitting beside a big, square-set man in a blue-gray mantle. The sentries present arms with a snap, and the big man begins to plan the psychological moment of the battle action. At the very juncture when the feigned retreat shall have led the enemy into a trap, and the grand advance of his armies will commence, he, the commander-in-chief, shall be there to lend spirit and dash by his presence, ready to correct a possible error in strategy, and insure the fullest measure of efficient generalship in every division, in every corps, in every army, and as between army and army.

No matter what one's sympathies may be, any fair-minded person with some comprehension of military matters must admit that in point of strategy and tactical efficiency the German army has proven itself distinctly superior to the allied armies. After a study of the various campaigns on the Russian and the Franco-Belgian borders I dare venture the assertion that had the operations been reversed and the allied commanders been forced to step into the shoes of the German commanders, to fight against numerically stronger enemies on two fronts simultaneously, they would have suffered defeat by this time. I do not mean to suggest by this that the allied commanders are deficient in strategy; on the contrary, they are very competent. The French, especially, have demonstrated a high degree of skill in tactical manœuvres; the Russians are much better officered and led than in former campaigns; the British closely rival the French in tactics and

outrival them in technical qualifications; at least the expeditionary regulars do, whatever the mobilised mercenaries may amount to. Even if Germany were to be defeated before this book can appear the strategy displayed by her Grosser Generalstab [Grand General Staff], and the tactical results obtained by army, corps, and division commanders, as directed by this staff, constitute a measure of preëminence in warfare so decidedly superior to the achievements of allied commanders that the latter would have more to learn from the defeat of the enemy than he could possibly learn from their victory. To bring home the essence of this situation to the commercially trained American mind suffice it to liken the German plan to a highly trained and completely equipped organisation pitted against an enterprise in which several decisive elements have been left to the initiative of circumstance. It is the difference between the department store method of conducting business and the shopkeeper's plan of resistance. The only arm of the allied forces that was up to the standard of maximum efficiency at the outbreak of war was the British navy, but there is no arm in

the German service that is not up to the requirements of the standard.

The Steel Ring Around Germany

The factors that have induced Germany during more than four decades to maintain a state of military readiness were of the downright compelling nature dictated by her geographical and industrial position, whereas the circumstances that induced her enemies to ally themselves against her were promoted by a combination of political and diplomatic aspirations. Germany is the only great power in the world that is surrounded by enemies. Russia has no frontiers in the sense that she does not fear an invasion threatening her existence. France has only one frontier to defend. England remains in a state of "splendid" isolation, leaving her frontier to the care of her navy.

On the other hand, consider Germany's extremely perplexing position. Toward the East she is confronted with the greatest land power on earth, whose main present ambition is to become mistress of the Baltic, a power that can put upward of ten million troops in the field

out of a total population of 170,000,000 inhabitants. Toward the West the German eagle is threatened by a power once dominant on the Continent, and while dominant always as brutally aggressive toward Germany as she became secretly jealous and vindictive after falling from her high estate. The campaigns of conquest waged on Germany by Napoleon and Louis XIV inflicted a much heavier blow at Prussia than the capture of Alsace-Lorraine at France. Toward the North, threatening her entire coast and her shipping, is the greatest maritime power in the world, with a record of always having opposed, for something like three centuries, whichever power, friend or foe alike, might happen to achieve dominance on the Continent. No single fact in the political history of Europe has been more thoroughly amplified than that, but it is not to be found in English text-books and readers. The national history of France, the Netherlands, Spain, Denmark, etc., are in evidence, however. The manner of waging war by England follows the precedent of utilising her vast political influence, based chiefly on her weight as a maritime power, to obtain an ally on the Continent

and incite the same against the dominant nation at the time. There has never been a time when England failed to procure a cat's-paw on the Continent, but of the nations who allowed themselves to be inveigled it is quite singular that not one has commemorated the event! Unless Belgium erects a monument in gratitude for that handful of British marines that conducted such a "masterful retreat" before Antwerp, the precedent of history will remain intact, and the Belgians have bought their status as cat's-paw with the loss of their country. On the South, Germany has one measurably dependable neutral "buffer" in the Swiss republic, which is fairly coining money in its rôle as middleman in munitions of war, and may be depended on to remain serenely neutral under these conditions. Historically, the status of Italy as an ally has earned the simile of a "man on the fence," and present events show that she means to pursue the glory attaching thereto.

A Pertinent Parallel

Such are the main outlines with which the strategy of German diplomacy has had to deal,

and which have induced and made necessary the unusually high degree of military preparedness on the part of the German Grand General Staff. I am well aware of the fact that the average American reader is not impressed by these conditions because he stands apart in a country separated from the human sources and basis of its being by an ocean of some three thousand miles. A parallel may, therefore, be quite opportune. The single state of Texas is big enough to accommodate Germany and France within its borders. Imagine, then, approximately half of this area peopled by sixty-five million people, adding to their number by one million babies annually. This was the population of the United States at the time of the war with Spain, and it is the population of Germany to-day. With this in mind let us transfer the United States population of anno 1900 to Europe and confine it to an area only half as large as Texas, within the constitutional boundaries of Germany, and let us surround it on all sides, shoulder to shoulder with powerful enemies, the same that Germany now is dealing with, does any sane person believe that the sixty-five million Americans thus confined

within Germany's borders would remain there under a negative, submissive national policy, permitting Russia and France to conspire against their safety, unchecked, standing idly by while England bullied their shipping off the high seas, counteracting their every move for colonial expansion? Would the affirmative be plausible if at the same time these expatriated American millions succeeded by dint of thoroughgoing application, aided by an orderly and efficient government, in becoming the leading progressive nation on the Continent not only in commerce and industry, but in science and invention, rivalling France in art, music and literature, and defeating England in foreign trade, even at her very doorstep in the colonies? Would it be wrong for an American population thus disposed behind German frontiers to contest for a share of the world's trade just because England has amassed to herself a world monopoly in foreign trade and shipping—because 46,000,000 Britons rule over one-fifth of the habitable globe? Would it be criminal to arm against the possible onslaught of a state like Russia, still modelling her foreign policy on the prescript of Tsar Peter

the Great, and already glutted with land to the extent of owning one-sixth of the habitable globe? Would it be "barbarous" to be similarly prepared against the French constantly nursing their historic case of injured vanity, conspiring secretly with Russia for revenge, though their decreasing birth-rate does not call for added territory, which they have acquired, nevertheless, in a very presentable colonial empire, considerably larger than the area of the United States? Add to these comparisons the fact that the American millions thus placed under the Prussian eagle would be required to suffer the additional mortification of standing by while the surrounding enemies would annex or capture valuable colonial possessions in all parts of the world, while preventing the Americans from getting even a decent foothold, and keep up this policy of estranging and isolating American interests for more than forty years! It is all very well to criticise Germany for attacking before she was herself attacked, for anticipating the ambuscade, so to speak. But it is dangerous to base a personal conviction on the data supplied by official press censors in the hire of the British Government whose con-

trol of the cables and the correspondents drawn on by the American press has gradually led, during the last four decades, to the dominance of American public opinion on political subjects abroad.

How Strategy Operates

The commander-in-chief conceives a general plan of action either for a defensive or an offensive campaign. He elaborates this plan with a view of disposing the various armies under his baton, in positions where it will be possible for them to operate against the enemy on the most favourable terms. He conceives the plan of campaign in its entirety, ignoring detail. He gives definite instructions to the commanders of the various armies, only. He imposes upon each commander a definite task, the objective, which is correlated to the tasks saddled on the commanders as a whole so as to insure uniformity of operation. He is in constant rapport with the army commanders. As their reports begin to come in over the wires he is in a position to determine the value of a certain progress made or gauge the setback caused

by a retreat. In the latter case, if the retreat is serious and continued, the commander-in-chief draws on his reserves to prevent a rout. Strange as it may seem, the reserves are the only soldiers who are under the personal command of the commander-in-chief. He follows the movements of the various armies on the map and does not accompany them in the field.

As the campaign progresses he is able to foresee where and when a decisive action is going to be fought; at least, this is possible so long as his armies are on the offensive. A first-rate C. I. C. does not suffer a chance like that to go by without inspiring his army chiefs by his presence. A high-powered automobile, preceded sometimes by a pilot car, takes him to the scene of action at racing speed. He takes no hand in the action, however, merely observes that his instructions, as given by wire, are properly carried out by the army commanders. If a reverse overtakes the embattled troops that could not be foreseen at the time of his issuing the instructions, on which the battle plan is based, the C. I. C. is right there on the spot to grasp the situation and issue remedial orders. The army commander, even if he has a quarter

of a million men under his baton, is powerless to issue strategical commands affecting the army as a body, even if he knows what to do and realises that not to do it may mean defeat. Such orders must come only from the C. I. C., and he alone is ultimately responsible. This, then, is the function of strategy as affecting military operations.

How Tactics Operate

Strategy is very frequently confounded with tactics, especially by the horde of novelists, humourists, star-reporters and funny men, which a resourceful press forthwith dispatched to the front and generously labelled "war-correspondents." Tactics may be said to begin where strategy leaves off. Sometimes they overlap. The strategic work of the C. I. C. is translated into tactical orders by the army commander, who is concerned with the movements of his particular army only. These orders are further specialised by the corps commanders, responsible for army corps only, and detailed to the division commanders in charge of divisions only, until they reach their ultimate

crystallised shape as regimental orders detailed on colonels in charge of regiments. Tactics, therefore, prescribe the operations of an army on the battlefield together with every unit of which the army is composed. The zone of tactics is confined, therefore, to the movement of troops upon the field of battle. The zone of strategy extends from the military base to the battle-lines governing the disposition and placing of troops in the hands of the tactical commanders at points selected for them. Thus, the work involved in placing seven armies in the field on the western frontier and coördinating their operations was strategy performed by Field-Marshal von Moltke, while the task of operating the right wing, for example, and fighting it against the allied left, was the tactical problem intrusted to General von Kluck. The field of strategic execution is the war map; the field of tactical operation is the battle-line.

A presentable volume could be written on the changes in tactics alone. In the present war the fatal zone of infantry and artillery fire is more than three times as large as it was in 1870, and the flattening of trajectories has made the fire so tremendously effective as to compel the

modern soldier to fight on his belly and advance like a mole digging its way in the earth. Add to this the fact that the rate of fire has been quadrupled—and in some arms even quintupled —which means that every man and every gun can fire at least four shots for every one that could be fired in the war of 1870, and it is no longer difficult to understand why shock action is not attempted to any extent. The only time soldiers expose their bodies in this war is at the moment when storming a trench, but even this is never attempted until the trench has been "singed" with shrapnel and made untenable. Hundreds of trenches have been taken by both sides in this manner only to be given up and evacuated owing to the enfilading fire of the flanking or supporting trenches.

During the first four months of the war the Germans were repeatedly criticised for "attacking in massed formation"—at least, this is how it looked to war correspondents posted some twenty miles to the rear! Undoubtedly these reports originated from the fact that whenever the Germans ordered an advance *en masse* it was made from behind cover, usually a shallow trench, during the storm-march into

France, and the men would attack, on the run, in open line of skirmishers, until close enough for shock action, when they would concentrate and lunge forward for the final assault. This plan of attack appears to have been quite successful in storming forts and intrenched camps, necessarily at an extraordinary loss of life, and while less suited to breaching permanent trenches it has proven to be about the only effective action for an army constantly marching forward and constantly urged to attack to keep up the pace. During the later phases of the campaign, when the Allies took the offensive, they were compelled to risk the same method, and only when they get so strong in men and material that they can afford to risk three lives in storming to one in the German trenches will they be able to assume a general offensive with a view of routing the enemy from his present solid line of intrenchments.

In this trench warfare it has been reported that both sides have availed themselves of old-fashioned weapons, like catapults, arrows, and old-style mortars. It is possible that individual detachments may have improvised something of this sort in the field, but there is no regular

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This picture was heralded as "The Kaiser and His Staff Studying War Maps at the Imperial Headquarters in Luxembourg.". As a matter of fact, the photograph was taken at an army maneuver before the war.

equipment of this description. The German army has a special machine for heavy trench work, called Minenwerfer, which is in reality a small mortar capable of tossing quite a heavy explosive shell into the opposing trenches. These mortars have given a good account of themselves, but the favourite weapon of close-in trench fighting is the hand grenade, which is sometimes launched with a sling; perhaps here we have the mystery of "catapults."

Why Paris Was Not Taken

The intrenchment tactics of the Germans have been described as a "rout" since they fell back from the Marne on previously selected positions beyond the Aisne. Subsequent events have shown that von Moltke's strategy was justified, for even if the Germans had pushed on to the very walls of Paris—and the French army was not, at the time, able to prevent it—they could have gained no permanent advantage by that, and they would then have committed themselves to a lengthy campaign of pursuit, which would have made it impossible for them to speedily reënforce their menaced Russian

frontier. By retreating to the Aisne and settling down to siege tactics in admirably constructed trenches the Germans were able to strip their forces of first-line troops and rush them to the Eastern frontier, making it possible for General von Hindenburg to achieve two clean-cut decisive victories, resulting in the capture and loss of nearly a quarter of million Russian troops. The check thus administered sufficed at least to delay the active resumption of the Russian advance by something like two months, and it is doubtful if a result of this magnitude could have been accomplished in France. On the other hand, had von Hindenburg failed—and he certainly would have failed without adequate reënforcement—the Russians might have been before Berlin at this writing, and at such heavy cost a decisive victory over the French could not be bought. Meanwhile, it must not be forgotten that Germany had virtually conquered Belgium together with the only part of Northern France of which she could hope to retain a piece eventually. Even if the German army had succeeded in investing Paris and driven the French army beyond the Loire and the Garonne, France would have

refused to capitulate so long as England and Russia remained her allies, depending quite naturally upon them to relieve the military pressure upon her, as they did. In other words, to have permitted the continued advance of the Imperial army would have been a great error of strategy and tantamount to sending it on a fool's errand. By stretching a solid line of trenches across her conquered territory in France and Belgium, based in the southeast on the Swiss Alps and in the northeast on the Channel coast, the German C. I. C. accomplished a master-stroke for by this plan of strategy he enabled his armies in the West to hold the main advantage gained by them, while he empowered his armies in the East to deliver a telling blow and preserve the frontier intact.

It is quite true that the Germans have made no advance of importance since this plan was carried into effect, that is, when we dispose of the capture of Antwerp and the march along the seaboard toward the Ypres terrain as relatively unimportant. But this much may be prophesied with certainty that should the Allies, who have entirely failed to pierce the German intrenched lines during several months of incessant field

operations, succeed in rolling the Germans back from the Ypres canal and retake Antwerp, this event would be heralded as something in the nature of a colossal and decisive victory. The Germans have no strategic motive in changing their plan of action on the French frontier until they can administer another blow at Russia that shall relieve their rear once more. The struggle for a base at Calais is purely tactical and of value principally to naval operations.

If the Germans can hold what they have gained on both frontiers they are quite safe from defeat, but they cannot hold it by simply holding on indefinitely. They have less to gain by purely defensive operations than their enemies. That the German C. I. C. fully realises this point is evident by the fact that since the German armies went into intrenchments along the Aisne they have assumed an offensive-defensive rather than a flat defence. That they are outnumbered has not prevented them from forcing such fighting as there has been; they have given the enemy no rest; tactically they are on the defensive, but their operations partake of the offensive.

Grand Scale Super-Strategy

With about four million troops disposed on a battle-line of two fronts covering about five hundred miles, and opposed by certainly not less than five million allied troops, the military problem confronting the German C. I. C. is so much vaster in extent and so much more difficult of solution as compared to even the mightiest wars of history that it has called into play a kind of super-strategy hitherto unapproached in warfare. When the war is over and the truth is ferreted out to the last button and bayonet, the well-nigh superhuman achievement of the Grand General Staff in expeditiously manipulating vast masses of troops on interior lines, flinging them from the Western frontier across Germany to the Eastern frontier to deliver a blow and back again to hold the Western intrenchments by the skin of their teeth, while all the time new troops are being fitted out at the barracks by the army corps and green recruits are drilled to a point of efficiency in a few weeks, is an exhibition of strategy on the grand scale that makes Napoleon's opera-

tions look like a pastime with toy soldiers. To frustrate the objects of the Prussian super-strategy the Allies have seized upon a plan of counter-operation, which has caused more damaging effect to the German arms than any tactical offensive by the Allies. Every time the Germans strip a line of intrenchments to reën-force their offensive on the Russian border the Allies answer by a counter-offensive on the French border, and vice versa a German advance on the Western frontier is retarded by a Russian advance on the Eastern frontier. No better plan of counter-strategy could be conceived. It put a stop to the German storm-march through France, and if it could be indefinitely continued on present terms the Allies would not have to win a decisive victory on the grand scale for the utter exhaustion and gradual decimation of the German forces would make it unnecessary. After almost six months of the most savagely contested battle action the German C. I. C. still holds the upper hand. He retains the advantages and territory gained in the initial advance. What he lost he has made up, meanwhile, in fresh acquisitions. His position is sound to the core and his armies are not

shaken. In the main he has had to take a good deal more punishment than he has inflicted, as a premium for assuming and maintaining the offensive for so long. He is still operating on interior lines—a huge advantage—and he has prevented the concerted efforts of allied enemies from invading his military borders. Even if he were driven by superior weight of numbers to take a defensive stand behind the Vistula on the East and the Rhine on the West, even if he lost all that had been gained in France and Belgium, the position of Germany would not be desperate, not even as serious as the status of France when the Prussian "pickelhauben" spiked the borders of the Marne.

In many ways the strategy pursued by the French C. I. C. is reminiscent of the Fabian policy of the Romans in dealing with the victorious armies of Hannibal, the Carthaginian conqueror. Every time the Roman senate dispatched an army against the invader it was defeated by Hannibal in open combat. The forces of Hannibal were as distinctly superior in military efficiency over the Roman legions as the German soldier to-day is superior to his allied opponents. For years Hannibal remained vic-

torious. He was by far the greatest military genius since Alexander the Great. Step by step he laid the possessions of Rome under his sceptre. Nothing, apparently, could save the city of Rome from conquest and sack. It was not until the Romans, after trying several makeshifts, adopted a consistent defensive and ceased to openly fight the army of Hannibal that they could devote themselves to the task of harassing its flanks and cutting off its lines of communications, which finally sapped the strength of the Carthaginians. The Romans skilfully avoided open battle during this campaign when they were steadily accumulating strength, and Hannibal was slowly petering out. Instead of moving upon Hannibal even at this auspicious juncture they dispatched Scipio with an army to Spain to fight Hasdrubal, the brother of Hannibal, on whom the latter depended for reënforcements. Scipio won. Then, and not until then, when Hannibal had forfeited his reserves, did the Roman legions move upon the isolated Carthaginian army, scoring a victory upon which the course of civilisation hinges as upon a pivot.

For six months the allied armies have emulated the Romans in defensive tactics as cer-

tainly as the German forces have followed the offensive of Hannibal. By attacking alternately on the eastern and western borders, though nominally remaining on the defensive, and leaving the task of forcing the fighting to the enemy, the Allies have gained in strength perceptibly more than they have suffered in punishment. Had they moved upon the Germans in a general offensive action the chances are that they would have suffered a decisive defeat. Should the Austrian army cease to be of practical aid to Germany, however, and become a burden, the strategic moment would have arrived when the Allies by simultaneously assuming a grand offensive action on both borders might place Germany in a position where she will have to fight a good deal harder than did Hannibal at Zama, to escape defeat.

The Strategic Status Quo

As matters stand at this writing the German C. I. C. has failed to complete the offensive planned on Calais, but he has managed to score two most decisive victories over the Russians in East Prussia and Poland, both of which were heralded as Muscovite triumphs by the romancing

censor of Petrograd. Despite these successes, which abundantly demonstrated the superiority of the Germans over the Russians on the battle-field, notwithstanding a noticeable improvement in the latter as compared with their showing in previous campaigns, ever so much more is required of the German soldier to win out in the long run because the Russian soldier, fighting on one front only, will be able to outnumber him in the proportion of three to one. It has been said and repeated that German statecraft has set a task for German strategy in a war on two fronts entirely beyond the capacity of the German army. Relatively speaking, this is true, but it still remains to be proven conclusively true. It must not be forgotten that a German C. I. C. once upset the calculated strategy of almost entire Europe in an attempt to crush Prussia, when she was not so well prepared as at present, and came out a victor under the historical title of Frederick the Great. The splendid resistance offered by the Servian and the Belgian armies in the face of overpowering odds remains as a present-day example of the latent and recuperative power of an army pushed to the extreme of its fighting

capacity when actuated by the undying courage of invincible valour and love of country. Never before in history has the German vaterland been so solidly united as at present. Never before have German troops gone into battle with a more formidable spirit of valour and self-sacrifice in order that the vaterland may be saved and its enemies may be vanquished. Irrespective of whether one likes or dislikes the Germans this much we must concede to them in all fairness. Should the German armies go down to defeat ultimately, snowed under by overpowering numbers, they may be depended on to battle heroically to the last, like the German cruisers scattered upon the high seas, every one of which knew that she was facing ultimate destruction and none of which surrendered to the enemy.

In general, the science of strategy has been less influenced by modern weapons and equipments than the tactical branches. If the elder Field-Marshal von Moltke were alive to-day he would probably be the first to reverse his tactical dictum, made famous in the Franco-Prussian war of '70-'71, to wit, "March divided, fight united."

EPILOGUE

A Weapon Against War

To try to stop war by peaceful means is about as futile as to lecture a cat for stealing milk. Peace is the cause of war. No matter how well and how long the human family may manage to live together peacefully, history shows with painful clearness that the longer a condition of peace endures the more certain it is to develop causes for war and to finally precipitate a condition of war. Mankind is engaged in perpetual warfare. Sometimes it pauses to catch its breath, and that is peace. There is no real and final peace. What we dignify by the term peace is only a sort of truce. History proves it, every page of it. Mankind ignores the lesson. Every generation thinks it is somehow better than the preceding. Imaginary betterment of this kind is supposed to bring about the disarmament of the nations if not the millennium. One only has to wait patiently and be good and the miracle

will happen of itself. But history never fails to apply its stringent lesson, and Europe is now smarting under it, showing that we are as far from the millennium as we ever were.

Mankind has never learnt anything of itself. It has been forced at every turn to learn, it has been kicked forward on the road to knowledge, it has been frightened into progress. War is a condition of mankind that cannot be abated by arguments. War will not cease until a weapon is found against it. Peace propaganda is about as effective as rotten oranges against a battleship. The pacifists make the mistake of assuming that public opinion is sufficient in itself as a compelling force. Public opinion is stronger in the United States than in any other country—in fact, it is the basic force for all governmental power—but if American public opinion decided in favour of disarmament to-day and determined upon a career of national peace, war would be forced upon the American nation, nevertheless.

There is nothing the matter with the peace proposition in itself, but it needs the backing of armed force. If we could bring the leading powers of the world together in a mutually pro-

tective association of interests aiming at peace everlasting, backed by their armed strength, we should be advancing on the proper path to a solution. Entirely aside from the present war if the Entente Cordiale and the Triple Alliance could be persuaded to reduce their armaments on a scale commensurate with native population and colonial interests, and if this reduction were to be radical, a heavy burden would be lifted from the shoulders of Europe. But comparative disarmament would offer no practical guarantee of peace. It is the first step, but much more remains to be done. If the nations involved could agree to abolish the means of mobilisation, secret armaments, strategic bases and railways, concentration centres, etc., and would content themselves with lining their mutual borders with a policing force of soldiery, subject to the call of the mutually protective association to enforce a state of peace in any serious emergency arising, it would be difficult to make war, and if war ensued, nevertheless, it would involve only the policing soldiery. In time, one might proceed further and provide that the soldiery lining the Franco-German borders, instead of guarding oppos-

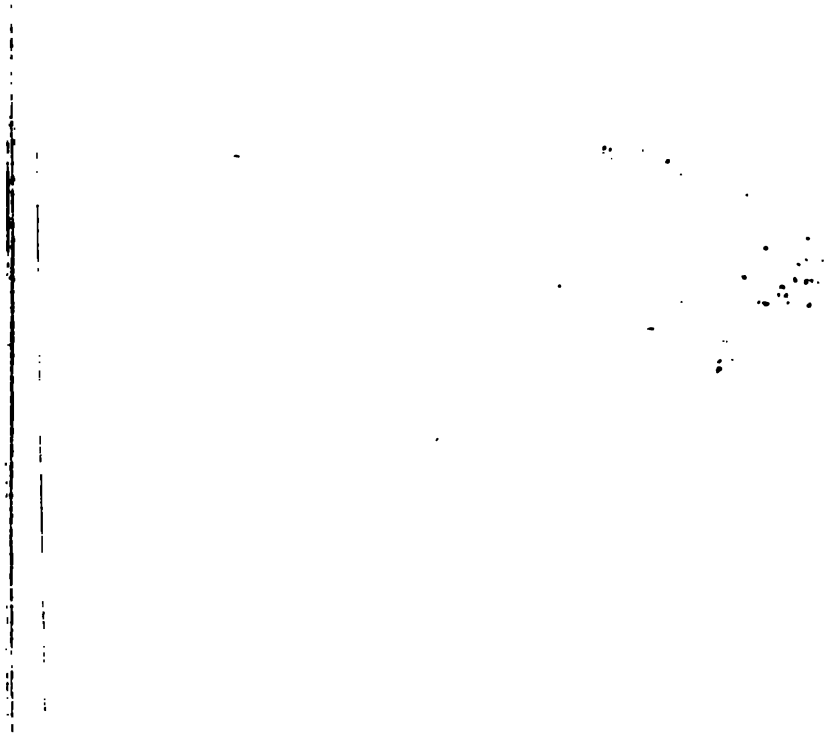
ing sides of the same line, should be fused into a Franco-German soldiery guarding the same border together. If all other borders in Europe were to be similarly protected against aggression, and the concentration and mobilisation of troops other than those actually stationed on the borders were made impossible, war could still be declared, but the chance of gaining anything by it would be so remote that no nation would care to declare war. On the other hand, the incentive to maintain a state of peace would be so strong as to constitute the first and foremost consideration of the powers involved. In such a scheme the demands of peace would have the backing of an armed force supported by the leading nations of the world, and the nation that would dare to break such a covenant would soon be subjugated by the other nations.

The meanest nation on earth will always insist on its right to defend itself by armed force, hence, absolute and unconditional disarmament is impracticable. Neither is it desirable, for a nation undefended is like a city unpoliced and soon becomes a burden or a prey to its neighbours. A border constabulary, however, even if

it amounts to an army in itself, is not dangerous to the world at large so long as it is deprived of means to mobilise and concentrate, and if the same agreement is entered into by the leading powers there should be no loss of dignity on the part of any one power.

The only serious obstacle to a practical realisation of this plan is the semi-feudal manner in which diplomacy is conducted, which makes the foreign policy of a nation a thing entirely foreign to the real desires and interests of the nation. This present war did not grow out of hatred between the citizens of the powers engaged; in fact, the citizens were most peacefully engaged in mutual, international relations requiring no resort to arms. Had the people been left to themselves there would have been no war. There was no serious clash of interests between them, only competitive rivalries in tradal and industrial fields. The clash came between the foreign and diplomatic policies of the governments ruling the peoples. These policies are the trouble-making tools of governments. The house of Romanoff has one originated by Tsar Peter the Great, the Hapsburgs have another, the Hohenzollerns have a

third, and the policies pursued by the British Parliament, the French Conseil and the American Congress, are just as prolific in trouble-making potency as any subscribed to under the imperial sceptre. They may cause war at any time, even though the peoples committed to them by birth and habitat are not in any sense inclined to war. Consequently, there can be no real and abiding progress toward lasting peace until the elements entering into the foreign policies of the nations have been substituted by elements in harmony with the natural life of the peoples. That such a time may arrive is conceivable, but it is so far off in the reckoning of space as to leave no immediate hope of a solution.



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